THE REVIEW
OF APPLIED
ENTOMOLOGY.

SERIES B: MEDICAL AND VETERINARY.

VOL. XX.
(1932.)

ISSUED BY THE IMPERIAL
INSTITUTE OF ENTOMOLOGY.

LONDON:
THE IMPERIAL INSTITUTE OF ENTOMOLOGY,
41, QUEEN'S GATE, S.W.7.

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ERRATA.

Page 2 line 27 for " 800 " read " 300 "
,, 21 ,, 35 ,, " Lewis (A.E.) " read " Lewis (E. A.) "
,, 42 ,, 26 after " and " insert " their offspring "
,, 50 ,, 1 for " Zinsser (M.) " read " Zinsser (H.) "
,, 84 ,, 34 ,, " *Silimium* " read " *Simulium* "
,, 133 ,, 13 ,, " *Protospiroptera* " read " *Protospirura* "
,, 136 8 lines from end for " *Ornithodorous* " read " *Ornithodorus* "
,, 216 line 27 for " 8·57 " read " 29·85 "
,, 216 ,, 28 ,, " 29·85 " read " 8·57 "

IMPERIAL INSTITUTE OF ENTOMOLOGY.

REVIEW
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APPLIED ENTOMOLOGY

SERIES B.

VOL. XX.] [1932.

Symposium on Malaria.—*Southern Med. J.*, xxiv, no. 5, pp. 407–463, 6 figs., 2 graphs, 2 maps, 2 diag., num. refs. Birmingham, Ala., May 1931.

This symposium includes papers on screening as an anti-malaria measure in sparsely populated rural areas, descriptions of anti-malaria campaigns in particular localities, and accounts of the malaria control work carried out during 1930 in various parts of the United States. In a paper entitled " Mosquito Control in Haiti, with especial Reference to the Use of Paris Green," by S. S. Cook (pp. 431–433), it is pointed out that owing to the importance of dengue and filariasis as well as malaria, and also to the possibility of the introduction of yellow fever by the aeroplanes of a service between New York and South American ports, which call at Port-au-Prince, it is necessary to control both Culicines and Anophelines. The former include *Aëdes taeniorhynchus*, Wied., and *A. sollicitans*, Wlk., which are abundant in the salt marshes along the coast and in the alkali flats in the interior, *A. argenteus*, Poir. (*aegypti*, auct.), which is widely distributed and very prevalent and breeds chiefly in containers but also in tree holes, *A. mediovittatus*, Coq., which breeds in tree holes and is an annoying biter indoors in the daytime, and *Culex fatigans*, Wied. (*quinquefasciatus*, Say), which prefers dirty water. The satisfactory results obtained with Paris green and moist sand [*cf. R.A.E.*, B, xviii, 233] against both Anophelines and Culicines have been confirmed, and as it is easier to handle and much cheaper than oil, it was adopted as the routine mosquito larvicide on 1st January 1930 and has since proved very satisfactory. Although it is widely used in places frequented by animals, no ill-effects have been reported.

In a paper by J. G. Ralston on " The Manufacture and Life of Screen Wire " (pp. 449–451) the methods of preparing black-painted and galvanised steel wire cloth and copper or bronze wire cloth are briefly described. It is pointed out that nothing coarser than a mesh of 16 by 16 per inch is effective for protection against Anophelines. After discussing the length of life of screens made from the various types of wire cloth, the author concludes that the most economical and practical are made of electro-galvanised steel wire of the best quality with a mesh of 16 by 16. The lives of screens may be prolonged by brushing them free from dust and dirt and painting them with boiled linseed oil in the case of galvanised steel cloth, or in the case of black painted screening, with a coating of black paint, thin enough not to block up the meshes.

LePrince (J. A.). **Cost of Malaria Control.**—*Amer. J. Publ. Hlth.*, xxi, no. 4, pp. 378–381. New York, N.Y., April 1931.

The author discusses the cost in various parts of the United States of such malaria control measures as destruction of mosquito larvae and screening. He points out that it is frequently necessary to spend considerably more than would be needed to eliminate the specific malaria vector (*Anopheles quadrimaculatus*, Say) because public approval of such campaigns depends to a large extent on the reduction of mosquitos in general. The cost per head of anti-larval measures in 71 towns and villages in 1920 and 1921 averaged between 3*s*. 0*d*. and 3*s*. 4*d*., at par, for the first year's work, which included the installation of new ditches. The cost of maintenance is about one-quarter to one-third of the initial outlay. The measures include ditching, the maintenance of ditches and the application of larvicides, and the costs are for mosquito control and not for the control of *A. quadrimaculatus* only. In tropical countries with heavy rainfall, long rainy seasons and clay soils, the cost of larval control is relatively high and the application of oil is rendered more expensive owing to the interference of quick-growing vegetation. During the construction of the Canal in Panama, where the annual rainfall is 60–180 inches, the cost of the mosquito campaign, exclusive of screening, was about ½*d*. per head per day for about 800 days in the year. In the greater part of the malaria belt in the United States, the Anopheline season only lasts about 130 working days, and during this period there are often dry intervals with less breeding. In the southern States millions of dollars are spent in connection with large artificial lakes by hydro-electric power companies on clearing to prevent Anopheline breeding, but where dwellings within Anopheline flight range of a lake are not numerous, the cost of screening would be much lower than the interest on the capital expenditure for clearing.

During 1927, about 8,000 dwellings of farm tenants were screened at an average cost of about £2 each. The screens last 4–5 years, or more if they are painted. Many families spend almost as much on mosquito nets as it would cost to keep the house effectively screened, and mosquito nets are of much less value as an anti-malaria measure, owing to the preference of Anophelines for resting on them and biting sleeping individuals when they happen to come into contact with the nets.

Martini (E.). **Ueber** *Anopheles bifurcatus* **und** *algeriensis*.—*Anz. Schädlingsk.*, vii, no. 10, pp. 109–110, 1 fig. Berlin, 15th October 1931.

Anopheles bifurcatus, L., which in Germany is considerably less common than *A. maculipennis*, Mg., was very numerous in June–August 1931 in many districts in the Black Forest, near Hamburg and in the Rhineland, probably owing to abundant rainfall. Egg batches were found to contain an average of 100 eggs, with a minimum of 6 and a maximum of 216. In the laboratory they were laid preferably on damp surfaces, close to, but not in, water [*cf. R.A.E.*, B, xviii, 81].

Several adults of a species that the author believes to be *A. algeriensis*, Theo., which has not been recorded north of the Alps, were observed in a locality in the Rhineland where the winter is usually very mild. In one instance, three batches of eggs were found that gave rise to larvae morphologically similar to those of *A. algeriensis*.

SHAPIRO (J. M.). **Report of the Malaria Research Unit.**—*Ann. Rep. Dept. Hlth. Palestine 1930*, pp. 109–110. Jerusalem, 1931.

Observations on the oviposition of *Anopheles sacharovi*, Favr (*elutus*, Edw.) in Palestine were made during January and February. In January captured females laid 110–120 eggs in a few days when kept in an incubator at 22° C. [71·6° F.] and fed on fruit juices only. The eggs hatched on the third day, but the larvae died in the first instar. During the last part of February, eggs were laid on water at a temperature of 11° C. [51·8° F.] in a room and 19° C. [66·2° F.] in an incubator. Those laid in the incubator hatched on the third day, and the larvae developed to the second instar in 15 days. Those laid in the room hatched in 10 days.

Breeding of *A. sacharovi* was observed in lower Galilee as early as February and was general throughout the country in April. *A. superpictus*, Grassi, began to breed in March and continued to do so throughout the summer. Hibernating larvae of *A. sergenti*, Theo., were collected in January and February; actual breeding began in May and increased from June onwards. Larvae of *A. pharoensis*, Theo., were found in May, and those of *A. hyrcanus*, Pall., and *A. algeriensis*, Theo., throughout the year. The breeding of *A. multicolor*, Camb., corresponded approximately with that of *A. superpictus*.

Experience has shown that though top-minnows (*Gambusia affinis*) feed voraciously on larvae in captivity, they are of less value under natural conditions.

SELWYN-CLARKE (P. S.). **The Seasonal Prevalence of Malaria in the Federated Malay States.**—*Malayan Med. J.*, vi, no. 3, pp. 67–81, 7 graphs, 25 refs. Singapore, September 1931.

In view of the fact that malaria is still the disease causing the greatest mortality in the Federated Malay States and that the malaria rate during the last 20 years has only been reduced from 17 to 10·5 per thousand, the author discusses the various factors that may affect the seasonal prevalence of the disease, largely from a review of the literature and statistics. He concludes that there is no evidence demonstrating any cyclic variation in its incidence over periods of years, nor any obvious correlation between total annual rainfall and malarial incidence during a period of 20 years. In the Federated Malay States as a whole, malaria is most prevalent in May and June, which are months of low rainfall. *Anopheles maculatus*, Theo., which is believed to be the most important vector, is capable of breeding throughout the year, but appears to have two maximum breeding periods, in March and September. The first period is not affected to any considerable extent by the April rains, whereas the heavy rains in October and November may actually result in a reduction in breeding, owing to the destruction of the larvae by drowning. The high morbidity and mortality rates in May lend support to the view that the maximum breeding of the vector may take place in March, but many more observations over a prolonged period and in several areas are necessary before it will be possible to affirm with any degree of certainty the actual factors influencing the seasonal incidence of malaria in the Federated Malay States, where such seasonal incidence undoubtedly occurs.

Brug (S. L.). **Culiciden der Deutschen Limnologischen Sunda-Expedition.**—*Arch. Hydrobiol.*, Suppl.-Bd. ix, *Trop. Binnengewässer*, ii, pp. 1–42, 74 figs., 1 pl., 1 table, 1 map. Stuttgart, 1931.

Notes are given on mosquitos collected as larvae or pupae in the mountain zones of the islands of Java, Sumatra and Bali, some of which were bred out. Their breeding-places and the localities where they were found, and also their recorded distribution are indicated. The Culicines include five new species and one new variety. The Anophelines are *Anopheles subpictus*, Grassi (*rossi*, Giles), *A. vagus*, Dön., *A. aconitus*, Dön., *A. kochi*, Dön., *A. maculatus*, Theo., *A. fuliginosus*, Giles, *A. barbirostris*, Wulp, *A. hyrcanus*, Pall., and *A. aitkeni*, James. Except in one case in which *A. barbirostris* was taken from a coconut shell, the Anophelines only occurred in the larger breeding-places (as opposed to tree-holes, bamboo stumps, etc.), this being probably due to the need for food and shelter afforded by aquatic plants and organic matter.

Wilkinson (S. A.), Stubbs (W. D.), Desai (V. M.) & Beharilal (K.). **A Malaria Survey of Ajmer City 1930.**—viii+30 pp., 5 figs., 1 map, 1 chart, 1 plan. Bombay, Times of India Press, 1931. (Abstract in *Trop. Dis. Bull.*, xxviii, no. 12, p. 988. London, December 1931.)

In the survey of a city in Rajputana in which outbreaks of malaria occur after heavy rain, the Anopheline concerned was found to be *Anopheles stephensi*, List. It bred in waste water from the public stand pipes, garden sumps, tubs, pots and pans, and also in pools left near the edges of two artificial lakes when these were drying in the hot weather.

Morin (H.), Mesnard (J.) & Bordes (L. A.). **Le paludisme en Indochine.**—*Arch. Inst. Pasteur Indochine*, no. 12, pp. 3–110, 10 pls., 3 plans, 5 graphs, 20 pp. refs. Saigon, October 1930. [Recd. November 1931.]

In the introduction (pp. 3–4), Morin points out that in view of the intended extension of the anti-malaria campaign to include the whole of Indo-China, a survey of the situation was undertaken with a view to determining the order of importance of the studies and work to be undertaken.

In the first paper " Les premières recherches sur le paludisme en Indochine " (pp. 5–18), Bordes reviews the distribution of malaria in Indo-China and the history of anti-malarial measures there and in Cochin China in particular.

Morin, in " Développement des recherches sur l'étiologie du paludisme en Indochine " (pp. 19–37), discusses the progress of research in the colony and incidentally summarises the work of foreign authors showing the importance of individual species of Anophelines in the transmission of malaria, and consequently the necessity for information on the bionomics of the local vector in the application of control measures.

In " Recherches sur le paludisme des régions de moyenne altitude en Indochine (1928–1930) " (pp. 39–52), the same author gives an account of investigations undertaken in 1928–30, some of which have already been noticed [*cf.* *R.A.E.*, B, xix, 50, 225]. It is concluded that in the forest zones of Indo-China, breeding of Anophelines occurs round each collection of huts where malaria is present, and *Anopheles maculatus*, Theo., and *A. minimus*, Theo., may always be found. The density of Anopheline vectors decreases rapidly as the distance from an infected village increases. Endemic malaria coincides with the presence of particular species of Anophelines. In healthy localities in the usually malarious red soil region these species are not encountered, whereas they are present in the grey soil region in infected foci. Moreover, these species have been found in calcareous soils as well as among volcanic rocks. Thus the chemical composition of the soil plays only a minor part in the constitution of an endemic zone. In two localities frequented by the same species, when other conditions are similar, the endemic rates are correlated with the topography of the district, the position of the Anopheline breeding-places and, consequently, the ease of access to human habitations. The maintenance of the malaria parasites appears to depend on the constancy of contacts between Anophelines and man, and malaria dies out when it is not maintained by incessant re-infections. In the regions of Indo-China under discussion, a campaign against the Anophelines appears to be the best method of malaria prevention, but the effectiveness of this procedure depends on the thoroughness with which it is carried out. In each particular situation the problem differs according to local conditions, and it is on the correct evaluation of the latter that the success of the campaign depends.

In " L'importance du réservoir de virus autochtone dans la lutte contre le paludisme en Indochine " (pp. 53–64), Mesnard and Bordes point out the importance of preventing so far as possible any contact with the indigenous population of the forests and mountains, many of whom are tolerant carriers of malaria parasites. It is suggested that temporary camps should be erected as far as possible from native villages. If natives are employed as guides, servants, etc., camps should be moved every 15 days before any local mosquitos that may have ingested parasites have become infective. In regard to clearing work, it would appear possible to return the native labourers employed on cutting operations to their villages two months before importing other workmen to carry out burning. Thus the Anophelines encountered by these men will have had sufficient time to lose their infecting power. In such cases the persons in charge of the work should live in screened houses and take quinine. Where the two groups of labourers must work together, the camps should be about 1¼ miles apart.

In the last paper " Développement de la lutte antimalarienne en Indochine. Premiers résultats obtenus," by Morin and Bordes, an account is given of the usual anti-malarial measures now employed and the manner in which the Institute Pasteur, Saigon, collaborates with various organisations that seek advice on their malaria problems. Finally, the satisfactory results of scientific anti-malarial campaigns carried out on various plantations are described, and it is affirmed that, from an industrial point of view, malaria prophylaxis in Indo-China on plantations in the red soil region where imported labour is employed is economically justified.

FENG (Lan-Chou). **Filariasis in China with special Reference to its Distribution and Transmission.**—*Nat. Med. J. China*, xvii, no. 4–5, pp. 464–474, 1 pl., 15 refs. Peiping, 1931.

Filariasis in China appears to be exclusively caused by *Filaria* (*Wuchereria*) *bancrofti*. The exact distribution of the disease is not known, but in general it occurs in low lying land, especially along the coast, on islands, and on the banks of large rivers or lakes of the tropical or sub-tropical regions. In the high lands of the interior it is extremely rare. The particular distribution may be explained by the method of transmission, since a high temperature with a certain amount of moisture is necessary not only for the development of the parasite in the mosquito but also for the transference of the mature larvae from the proboscis of the vector to the human skin. Cold weather is unfavourable, and dryness and high temperature are injurious to the filarial larvae after they leave the proboscis. Thus, in many cases in the interior, the disease is rare or absent, although proved carriers are present.

A survey carried out near Shanghai has definitely proved *Anopheles hyrcanus* var. *sinensis*, Wied., to be a vector of *F. bancrofti*. A summary is given of the results, which have already been noticed from a fuller account [*R.A.E.*, B, xix, 250]. The suggestions for control include the usual anti-mosquito measures, such as filling and draining of breeding-places, the use of larvicidal fish and Paris green, and the employment of mosquito nets and screens.

In an appendix, the distinguishing characters of *A. hyrcanus* var. *sinensis* are given. Observations on its breeding habits in Woosung, Soochow and Nanking during the summer of 1930 confirm those made by Meleney in north and central China [xv, 184]. In addition to the commoner breeding-places, temporary rain pools, marshy swamps and excavations along roads are also occasionally utilised. The adults, which attack man voraciously, usually enter houses and bite during the night. In certain localities this species formed over 80 per cent. of the mosquitos found in houses.

FENG (Lan-Chou). **The Larvae and Pupae of the North China Species of** *Anopheles*; **their Structure and Breeding Habits.**—*Nat. Med. J. China*, xvii, no. 4–5, pp. 493–512, 4 pls., 16 refs. Peiping, 1931.

Descriptions are given of the larvae and pupae of *Anopheles pattoni*, Chr., *A. lindesayi* var. *japonicus*, Yam., and *A. hyrcanus* var. *sinensis*, Wied., and the characters distinguishing them are tabulated. The breeding-places of these species are discussed [*cf. R.A.E.*, B, xv, 184; xvi, 42]. Observations and experiments undertaken in Peking indicate that the larvae of *A. pattoni* hibernate in water under ice in the winter. Towards the end of October, it was noticed that the number of larvae of this species was increasing and that most of them were in the first or second instars. On 23rd November, the larvae, which were under a thin layer of ice, were all in the first and second instars and were as numerous as before. They usually remained at the bottom in the morning, came to the surface when it grew warmer and sank again at night, thus escaping being incorporated in the ice. When the ice was an inch thick, the larvae were still numerous, but no mature larvae or pupae were found. Later, several hundred larvae were obtained from a pool on which the ice was 18 inches thick, but none were found in the ice itself. Similar observations were made at the end of January in Shantung Province. Large masses of filamentous algae, present with the hibernating larvae, appear to be of great importance in keeping the larvae submerged and providing a constant supply of oxygen when the water is separated from the air by a thick layer of ice. Moreover, when the water is so shallow that the whole depth tends to become frozen, the algae liberate oxygen in the form of bubbles with a thin layer of water in the ice in which the larvae lodge and so escape being frozen. This observation was confirmed by an experiment in which algae were added to one of two bottles each containing the same quantity of water and 10 second-instar larvae of *A. pattoni*. When the water in both was frozen, the bottle with algae contained many air bubbles and some water in the centre of the ice mass in which the larvae were confined. In the other bottle the water was entirely frozen and the larvae were scattered. On allowing the ice to thaw, it was found that all but one of the larvae in the bottle with the algae had survived, whereas all the larvae in the other bottle had died. This experiment was confirmed, using bowls in place of bottles. A large bottle containing algae and 50 larvae was placed in the open from 10th January until the end of April and 28 of the larvae gave rise to adults during the latter month. On 12th April pools that had been visited in the previous winter were found to contain fourth instar larvae, but no small ones, a fact that suggests that these larvae had successfully survived the winter. It does not appear likely that this species passes the winter in the egg stage [*cf.* xvi, 247].

Larvae of *A. lindesayi* var. *japonicus* were not able to withstand a temperature of $-5°$ C. [23° F.], which had no effect on those of *A. pattoni*; it therefore seems probable that the former species hibernates in the adult stage.

Observations made near Peking showed larvae of *A. hyrcanus* var. *sinensis* to be present in all instars in August and September. The numbers increased in October, but the larvae were nearly all mature. Towards the end of October they became less numerous, and at the end of November after a light fall of snow only a few dead fourth instar larvae were found. At that time the water was not frozen, and the general condition of the pond was practically the same as before. Thus it appears that all the mosquitos had matured and were hibernating in the adult stage.

YANG (Ching-Po). **Observations on the Incidence of *Anopheles* in a rural Area outside Peiping and on the Conditions of *Anopheles* Breeding.**—*Nat. Med. J. China*, xvii, no. 4–5, pp. 513–520, 1 pl., 1 ref. Peiping, 1931.

Further observations on Anophelines at Yenching [*R.A.E.*, B, xvii, 11] were made from 20th July to 25th August 1928. Their numbers increased gradually from 26th July until 22nd August, when there was a sudden sharp rise, which can only be explained by assuming a general increase in breeding areas following heavy rain ten days previously. Larvae were constantly found in the floating vegetation along the edges of ponds used for the commercial growing of waterlilies and reeds, but none occurred in ponds without vegetation in which fish were bred. In general, the larvae were most abundant in ponds with vegetation but no fish, although they were also numerous in the presence of fish in ponds with a thick covering of floating vegetation. They occurred in moderate numbers in ponds with fish and only scant vegetation. In ponds with floating vegetation and larvivorous fish, there was a temporary decrease in breeding immediately after rainfall, a fact which is explained by assuming that the larvae were more exposed to the attacks of the fish owing to the temporary submersion of the floating vegetation.

When two artificial ponds were left free from vegetation for three days, no larvae occurred, but well-developed Culicine larvae were observed five days after the addition of a species of *Ceratophyllum* to one of the ponds, and small Anopheline larvae occurred on the following day. The other pond remained negative, and it therefore appears that surface vegetation attracts ovipositing females. In another experiment one pond was stocked with *Ceratophyllum* and the other with a species of *Spirodela*. On the fifth day both Anopheline and Culicine larvae were recovered from the former, but not from the latter. Both ponds were then stocked with 500 larvae and a moderate amount of *Ceratophyllum*, and 10 fish (*Polyacanthus opercularis*) were placed in one. On the following day ten dips resulted in the recovery of 6 larvae from the pond with the fish and 72 from the control. In further experiments, it was found that if the surface vegetation was dense enough to impede the activity of the fish, little difference between the two ponds could be noted. *P. opercularis* is not a typical top-feeding fish, and it is not certain whether it would prove so effective in natural waters where other prey is abundant beneath the surface.

The results of laboratory experiments with fish in jars agree fairly well with the observations made under natural conditions. The protective value of vegetation was confirmed. Longer time was required for the extermination of the larvae when other insects were present, but the data are insufficient to warrant any general conclusion. In the laboratory two species of deep-water fish devoured the Anopheline larvae as readily as three species of surface feeders, but under natural conditions the former may not be so effective as the latter. It is concluded that the removal of vegetation, particularly the floating varieties, from ponds and streams and the use of larvicidal fish would considerably reduce the amount of Anopheline breeding.

Ho (C.). **Study of the Adult Culicids of Peiping.**—*Bull. Fan Mem. Inst. Biol.*, ii, no. 8, pp. 107–175, 16 figs., 24 refs. Peiping, 15th June 1931.

Although the mosquitos of Peking have been previously described from other localities, the literature on them is scattered. The author therefore redescribes the adults and gives details of their breeding-places. The Anophelines recorded are *Anopheles hyrcanus* var. *sinensis*, Wied., and *A. pattoni*, Chr. A few adults of the former were obtained indoors and some pupae, in association with those of *A. pattoni*, were collected in a muddy grass field shortly after a shower. The larvae are usually found in the stagnant waters of pools and ponds and sometimes appear sparingly along the shores of lakes and slow streams. The larvae of *A. pattoni* are very common in the small collections of water in stream beds and along the borders of these streams where the thick growth of filamentous algae protects them from being carried away by the current or devoured by small fish.

GREEN (R. G.). **The Occurrence of** *Bact. tularense* **in the Eastern Wood Tick,** *Dermacentor variabilis.—Amer. J. Hyg.*, xiv, no. 3, pp. 600–613, 24 refs. Baltimore, Md., November 1931.

The following is taken from the author's summary: *Bacterium tularense* has been isolated directly, by guineapig inoculation and subsequent culture, from 0·1 per cent. of the individuals of *Dermacentor variabilis*, Say (eastern wood tick) collected over an area of 20 square miles in central Minnesota during the summer of 1930. The animal culture derived from the ticks was of low virulence, as indicated by the type of lesion produced and by consistent failure to produce fatal infections in rabbits.

HU (S. M. K.). **Studies on Host-parasite Relationships of** *Dirofilaria immitis* **Leidy and its Culicine intermediate Hosts.**—*Amer. J. Hyg.*, xiv, no 3, pp. 614–629, 2 pls., 8 refs. Baltimore, Md., November 1931.

In the course of experiments undertaken in Maryland with mosquitos fed on dogs infected with *Filaria* (*Dirofilaria*) *immitis*, the development of the Nematode was traced to the infective stage for the first time in five species, *viz.*, *Anopheles punctipennis*, Say, *Aëdes canadensis*, Theo., *A. sollicitans*, Wlk., *A. taeniorhynchus*, Wied., and *Culex territans*, Wlk. In *C. salinarius*, Coq., it was found in the intermediate sausage stage of development. Infective larvae appeared in the labia of *Aëdes vexans*, Mg., *A. argenteus*, Poir. (*aegypti*, auct.) and *Culex pipiens*, L., thus confirming the records of other workers that these species may serve as intermediate hosts. There is a marked variation in the susceptibility to infection with *F. immitis* in the species of mosquitos tested, both in the average percentage of individuals that become infected and in the number of filariae that become established in the mosquito. The rather uniform density of infection found to be peculiar to each species of mosquito under observation appears to indicate that each has a characteristic limit in its range of variation in susceptibility.

BENARROCH (E. I.). **Studies on Malaria in Venezuela.**—*Amer. J. Hyg.*, xiv, no. 3, pp. 690–693, 2 refs. Baltimore, Md., November 1931.

Localised outbreaks of malaria occurred from May to December 1930 in different suburbs of Maracay, Venezuela [*cf. R.A.E.*, B, xvii, 108]. Of 179 Anophelines taken in one heavily infected locality, 169 were *Anopheles darlingi*, Root, a species that had been identified only 9 times among more than 20,000 specimens examined during the previous three years (1927–29). Dissections carried out during December and January showed 12 out of 114 females of this species to be infected, and four of these to be infective. As malaria had been relatively infrequent in Maracay since 1927 and as the Anopheline density as a whole was approximately the same as in previous years, it seems probable that the outbreak was due to a local increase in the numbers of this important vector. Observations on another of the outbreaks at a spot where *A. albimanus*, Wied., and *A. darlingi* were not found, indicate that the vector was probably *A. bachmanni*, Petrocchi.

Davis (N. C.) & Shannon (R. C.). **Further Attempts to transmit Yellow Fever with Mosquitoes of South America.**—*Amer. J. Hyg.*, xiv, no. 3, pp. 715–722, 4 refs. Baltimore, Md., November 1931.

The following is taken from the authors' summary of experiments in Brazil: By the injection of mosquitos that had fed on monkeys (*Macacus rhesus*) infected with yellow fever and had then been kept for a period equal to that of the extrinsic incubation of the virus in *Aëdes argenteus*, Poir. (*aegypti*, auct.), infections were obtained with the following species: *Aëdes terrens*, Wlk., *A. serratus*, Theo., *Psorophora cingulata*, F., *P. ferox*, Humb., *Mansonia fasciolata*, Arrib., *M. chrysonotum*, Peryassú, and *M. albicosta*, Chagas. From the bites of representatives of this list that accepted a second blood meal before injection, no infections resulted.

The survival of the virus for a period equal to that of extrinsic incubation in *A. argenteus* was not demonstrated in the following species tested: *Aëdes fulvithorax*, Lutz, *Anopheles albitarsis*, Arrib., *A. tarsimaculatus*, Goeldi, *Culex fatigans*, Wied. (*quinquefasciatus*, Say) and *Trichoprosopon* (*Joblotia*) *digitatum*, Rond.

Nieschulz (O.) & Bos (A.). **Ueber die Larvenentwicklung von** *Culex pipiens* **bei höheren Temperaturen.** [Larval Development of *C. pipiens* at high Temperatures.]—*Z. Parasitenk.*, iii, no. 4, pp. 741–746, 1 fig., 1 ref. Berlin, 28th August 1931.

The authors bred some 250 larvae of *Culex pipiens*, L., from the egg at constant high temperatures. At an average temperature of 25·5° C. [77·9° F.] 89 per cent. produced adults, at 26·5° C. [79·7° F.] 94 per cent., and at 29° C. [84·2° F.] 79 per cent., the average time of development being 17–18 days. The larvae can, therefore, contrary to Roubaud's finding [*R.A.E.*, B, xviii, 81], mature at a continuous temperature of over 25° C. [77° F.] without any check occurring in development.

Hase (A.). **Ueber Lebensbedingungen, Verhalten und Fruchtbarkeit der tropischen Hauswanze** *Cimex rotundatus* **Sign. (Hex. Rhynch.) in Venezuela. Beiträge zur experimentellen Parasitologie 7.** [Biology, Behaviour and Fertility of the tropical House-Bug in Venezuela. Contributions to experimental Parasitology 7.]—*Z. Parasitenk.*, iii, no. 4, pp. 837–893, 11 figs., 3 pp. refs. Berlin, 28th August 1931.

A detailed account is given of the course of development and life-history of *Cimex hemiptera*, F. (*rotundatus*, Sign.) in the actual climatic conditions of Puerto la Cruz, Venezuela. Owing to the high temperature, averaging 27·03° C. [80·65° F.], the females fed almost daily. Oviposition began 4 days after the first feed, an average of 2·2–4·8 eggs being laid daily by individual females. The proportion of surviving progeny fluctuated from 56·6 to 98·3 per cent. of the eggs laid. The eggs proved very susceptible to low temperatures; after 5 days at

0·5° C. [32·9° F.] only 4·05 per cent. hatched, and after 8 days only 2·8 per cent. The incubation period was subject to considerable individual variation, and the difference between early and late hatching larvae from the same batch of eggs was sometimes as great as 5 days.

KINGSBURY (A. N.). **Annual Report of the Institute for Medical Research for the Year 1930.**—*Ann. Rep. Med. Dept. F.M.S. 1930*, pp. 95–185. Also separately published, 91 pp. Kuala Lumpur, 1931.

Observations on tropical typhus in Malaya confirmed those already recorded [*R.A.E.*, B, xix, 97].

The use of plasmochin was found to be of definite value in malaria prophylaxis, the parasite rate on one estate being reduced from 28 to 17 per cent. in 9 months, and the gametocyte rate for *Plasmodium falciparum* from 10·6 to nil. To test the effect of plasmochin on the infectivity to mosquitos of crescent carriers, experiments were undertaken in which fresh batches of *Anopheles maculatus*, Theo., and *A. philippinensis*, Ludl., were fed daily on crescent carriers both before plasmochin was administered and during treatment twice daily with ·02 gms. A total of 2,040 mosquitos was applied in batches of 20–40 to 11 gametocyte carriers. After an interval of 15 days, the salivary glands were examined for sporozoites. The results indicated that the crescent carriers are rendered non-infective to Anophelines after receiving 0·4 gms. of plasmochin and remain so for a period of at least 3 days. From further observations, it is concluded that plasmochin does not prevent crescents that are almost fully-mature from appearing in the peripheral blood, but that gametocytes in the early stages of development are destroyed. Quinine and quinine-stovarsol were found to have little effect on the gametocytes of *P. falciparum*, Anophelines being infected from a crescent carrier even on the 25th day of treatment with quinine-stovarsol.

Experiments with colours appear to indicate that Anophelines prefer black during the day and white at night. It has frequently been observed that waters with a considerable iron content are comparatively free from Anopheline larvae. To check this observation a quantity of iron pyrites was buried at the heads of and at intervals along certain drains. Anopheline breeding was subsequently found in both the treated and control areas, but the number of breeding-places was definitely less in the former.

KEMP (H. A.). **Endemic Typhus Fever. Rat Flea as a possible Vector.**—*J. Amer. Med. Ass.*, xcvii, no. 11, pp. 775–777, 6 refs. Chicago, Ill., 12th September 1931.

In the course of their work on the tropical rat mite, *Liponyssus bacoti*, Hirst, and its connection with a skin eruption in man [*R.A.E.*, B, xix, 178], Shelmire and Dove collected a number of fleas (*Ceratophyllus fasciatus*, Bosc, and *Xenopsylla cheopis*, Roths.) from rats caught in a town in Texas in which large numbers of cases of endemic typhus [Brill's disease] had occurred. The present author gives an account of experiments in which emulsions of a number of these fleas were inoculated into guineapigs. These animals developed lesions characteristic of endemic typhus and after recovery were immune from a strain of the virus established from the blood of a patient suffering from endemic typhus. Conversely, guineapigs that had recovered from inoculations of the human blood strain were immune from the rat-flea strain. [*Cf.* also xix, 257, etc.]

RAO (M. A. NARAYAN) & AYYAR (L. S. PARAMESWARA). **Some Observations on Trypanosomiasis in Madras Presidency.**—*Ind. Vet. J.*, viii, no. 2, pp. 111–118, 1 fig., 1 graph, 1 map. Madras, October 1931.

In Madras, horses, donkeys and mules are most susceptible to surra, although dogs are also affected. Buffalos and cattle may harbour trypanosomes without manifesting symptoms, though outbreaks of trypanosomiasis of cattle have been observed in this region in which the mortality was 20–30 per cent. Acute cases, causing sudden death in cattle, apparently in good condition, and chronic cases, showing progressive anaemia before death, have both been observed. The disease appears to be widely distributed throughout the Presidency, but is more prevalent in the north. The seasonal incidence shows three peaks, one before, one during and one after the monsoon, the last one, which occurs during the cold weather, being the highest. The possible relation between the incidence of the disease and the prevalence of Tabanids is discussed, and the authors suggest that, as the highest peak occurs when these flies are rare or absent, the disease may be transmitted by smaller blood-sucking Diptera, such as Simuliids, etc. Experiments in which ticks (*Ornithodorus savignyi*, Aud.) were fed on an infected dog, and, three weeks later, on a healthy rat, dog and calf, gave negative results. Moreover, no infection was produced when blood containing a few motionless trypanosomes from the gut of a tick fed 5 days previously was injected into a healthy rat. A comparison of the incidence of surra in cattle and horses does not support the view that cattle and buffalos are the reservoir from which the latter become infected.

In addition to a small, monomorphic trypanosome, probably *Trypanosoma evansi*, found in horse, dog, and bovines, a larger form, which may be *T. theileri*, was obtained from cattle only. The latter could be established by inoculation in calves, but not in laboratory animals or dogs. At present it is believed not to be pathogenic, but further investigations are necessary.

DE BUEN (E.) & DE LA CAMARA (P.). **Considérations sur la fièvre récurrente espagnole.**—*Bol. tec. Direcc. gen. Sanid.*, vi, no. 4, p. 193. *Sine loco*, April 1931. (Abstract in *Bull. mens. Off. int. Hyg. publ.*, xxiii, fasc. 10, p. 1861. Paris, October 1931.)

In the course of an anti-malarial campaign in Spain, the authors discovered several foci of Spanish relapsing fever [caused by *Spirochaeta hispanica*], in which *Ornithodorus erraticus*, Lucas (*marocanus*, Vélu) was known to be present. Further cases were discovered in September 1930 in a locality where ticks were absent from houses, but large numbers of nymphs of *O. erraticus* were found on white rats and guineapigs exposed for several hours in the sewage canals in which some of the infected persons had worked. Of the 7 rats employed, 6 showed spirochaetes in their blood at the end of 5–8 days. A case of relapsing fever also occurred in a dwelling near a piggery, and as *O. erraticus* could not be found, *Haematopinus suis*, L., which was numerous, was suspected of being the vector. Negative results were, however, obtained when an emulsion of 30 of these lice was inoculated into a guineapig.

PINTO (C.) & DI PRIMIO (R.). **Contribuição para a biologia dos Ixodidae do Estado do Rio Grande do Sul (Brasil).** [A Contribution to the Biology of the Ixodids of the State of Rio Grande do Sul, Brazil.]—*Rev. med.-cirurg. Brasil*, xxxix, no. 7, pp. 236–239, 2 pls. Rio de Janeiro, July 1931.

Notes are given on the results of an investigation on ticks between December 1930 and February 1931 in Rio Grande do Sul. The Argasid, *Ornithodorus brasiliensis*, Aragão, is found on the soil near dwellings or places where small domestic animals are present. It occurs in a locality where temperatures as low as −8° C. [17·6° F.] are common in June, July and August. The Ixodids recorded are *Boophilus annulatus microplus*, Can., which is the vector of piroplasmosis of cattle and is very common in spite of the use of tick dips ; and *Amblyomma ovale*, Koch, and *A. maculatum*, Koch, which were both taken from dogs.

CARNES (E. H.). **Rat-flea Survey of the Port of St. Thomas, Virgin Islands.**—*Publ. Hlth. Rep.*, xlvi, no. 43, pp. 2558–2562, 1 chart, 4 refs. Washington, D.C., 23rd October 1931.

During a rat-flea survey of the port of St. Thomas, Virgin Islands, undertaken from 1st July 1929 to 30th June 1930, 309 individuals of *Mus* (*Rattus*) *rattus alexandrinus* and 3 of *M. rattus* were trapped. The absence of *M. norvegicus* is thought to be due to the lack of suitable harbourage for this species and to the presence of the mongoose, which has probably destroyed all rats not adapted to life in trees or houses. Of the 2,113 fleas collected, 99·7 per cent. were *Xenopsylla cheopis*, Roths. The average rat-flea index was 6·7, which was also approximately the *cheopis* index. The latter was high throughout the year, but highest from March to September inclusive. All the conditions appear to be favourable to the propagation of plague, and every effort is therefore being made to prevent its introduction.

FAUST (E. C.). **The Animal Parasites of the Dog and the Cat in China.**—*Lingnan Sci. J.*, viii (1929), pp. 27–44, 27 refs. Canton, July 1931.

This paper includes a section on the Arthropod parasites of dogs and cats in China, of which fleas are the most common. *Pulex irritans*, L., is the species most abundant on dogs in the north and *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., in the south. Cats are usually infested with *C.* (*C.*) *felis*, Bch., but the other two fleas are occasionally found on them. Dogs are occasionally attacked by *Trichodectes canis*, DeG., and often by ticks and by *Sarcoptes canis*, Gerl. *Linguatula serrata*, Froehl. (*rhinaria*, Rudolphi) is sometimes found in the nasal passages of dogs (the infection being acquired by eating infested rabbits), and an allied species, *Kiricephalus pattoni*, Stephens, has once been collected from a cat (this infection resulting from eating snakes harbouring the larval stage of the parasite). Dogs are frequently bitten by *Hippobosca capensis*, Olf. (*francilloni*, Leach), particularly on the neck and in the lobes of the ear, and by mosquitos, which are most annoying to dogs that have been shaved. *Filaria* (*Dirofilaria*) *immitis* is transmitted by mosquitos, and kennels should therefore be screened after sunset.

Edwards (F. W.). **Diptera of Patagonia and South Chile based mainly on Material in the British Museum (Natural History). Part II—Fasc. 4. Simuliidae.**—pp. 121–154, 7 figs., 5 refs. London, Brit. Mus. (Nat. Hist), 1931.

During the preparation of this report, the author studied the whole of the British Museum collection of Simuliidae, comprising over 120 species. He considers that none of the divisions of other authors can be accorded generic status, except probably *Parasimulium*, the characters of which are indicated and which includes only one North American species [*furcatum*, Mall.]. The characters of the venation in this family are discussed. The author recognises 7 subgenera of *Simulium*, to which a key is given, *viz.*, *Prosimulium*, *Gigantodax*, *Austrosimulium*, *Morops*, *Cnephia*, *Eusimulium* and *Simulium*, s. str. Twelve new species are described.

Ingram (A.) & Macfie (J. W. S.). **Diptera of Patagonia and South Chile based mainly on Material in the British Museum (Natural History). Part II—Fasc. 4. Ceratopogonidae.**—pp. 155–232, 21 figs. London, Brit. Mus. (Nat. Hist.), 1931.

The collection consists of 297 specimens. The common genera with a world-wide distribution, *Forcipomyia*, *Atrichopogon*, *Dasyhelea*, *Stilobezzia* and *Palpomyia* are all well represented, but it is noteworthy that there are no examples of the genera *Culicoides* or *Bezzia*. The apparent absence of *Culicoides* is of special interest on account of its blood-sucking habits. Several new genera and species are described, and a few species from other localities in South America are included in an appendix.

Pinto (C.). **Hypopygio ou terminalia das moscas hematophagas Stomoxydinae (Diptera. Muscidae).**—*Rev. med.-cirurg. Brasil*, xxxix, no. 7, pp. 248–254, 7 figs., 1 ref. Rio de Janeiro, July 1931.

Borgmeier (T.). **Nota sobre** *Neivamyia lutzi* **Pinto et Fonseca (Dipt., Muscidae).**—*Rev. Ent.*, i, fasc. 2, pp. 224–228, 1 fig. São Paulo, 15th July 1931.

Pinto (C.). **A proposito da "Nota sobre** *Neivamyia lutzi* **Pinto et Fonseca por T. Borgmeier."**—*Bol. biol.*, fasc. 17, pp. 19–20. Rio de Janeiro, 10th August 1931.

Townsend (C. H. T.). **On** *Neivamyia* **and its Allies.**—*Rev. Ent.*, i, fasc. 4, pp. 479–482. São Paulo, 14th November 1931.

These papers discuss the identity of *Neivamyia lutzi*, Pinto & Fons. [*R.A.E.*, B, xix, 90]. Pinto describes the genitalia of this fly and of *Stomoxys calcitrans*, L., *S. indica*, Picard, and *Lyperosia exigua*, de Meij. Borgmeier gives a further description of *N. lutzi* and compares the genus with *Bdellia* to which he considers it to be very closely allied. Townsend, while accepting the view that it is distinct from *Bdellia*, though very near it, points out that this blood-sucking fly was described in 1928 from Dutch Guiana by Malloch under the name of *Bdellolarynx flavicornis* and that its proper name should therefore be *Neivamyia flavicornis*, Mall. (*lutzi*, Pin. & Fons.).

AUBERTIN (D.). **Note on the Identity of two Species of the Genus** *Calliphora* **(Diptera).**—*Ann. Mag. Nat. Hist.*, (10) viii, no. 48, pp. 615–616, 2 figs. London, December 1931.

The only specimen of *Calliphora aucta*, Wlk., in the British Museum collection, which is regarded as the type, is an undersized, rather lightly chitinised female in extremely poor condition, and it appears to be a specimen of *C. erythrocephala*, Mg. In any case it is distinct from the species referred to by Patton [*R.A.E.*, B, x, 154] as common in India. The latter is described from both sexes as *C. pattoni*, sp. n.

RICHARDSON (H. H.). **The Pyrethrin I Content of Pyrethrum Powders as an Index of insecticidal Power.**—*J. Econ. Ent.*, xxiv, no. 5, pp. 1098–1106, 11 refs. Geneva, N.Y., October 1931.

The following is the author's abstract : The pyrethrin I content of several fresh pyrethrum powders was found to give an accurate evaluation of the insecticidal power of kerosene extracts of these flowers. Pyrethrin I was analysed by Tattersfield's short acid method ; insecticidal power was estimated by the speed of paralytic action against house-flies (*Musca domestica*, L.). A correlation coefficient of 0·987 was found between these two factors. The above conclusion was found to hold true for deteriorated pyrethrum as well as for fresh powder.

SCHWARZ (L.) & DECKERT (W.). **Zur hygienischen Beurteilung von T-Gas (Aethylenoxyd) als Schädlingsbekämpfungsmittel. II. Mitteilung : Praktische Durchgasungsversuche auf Schiffen.** [The Value of T-Gas (Ethylene Oxide) as a Fumigant against Pests. 2nd Report : Practical Experiments in the Fumigation of Ships.]—*Z. Desinfekt.*, xxiii, no. 10, pp. 405–416, 7 refs. Dresden, October 1931.

Experiments were carried out at Hamburg in May 1930 on the fumigation of ships with a mixture of 1 part of ethylene oxide and 9 of carbon dioxide [*cf. R.A.E.*, A, xix, 461], in order to determine its effect at low temperatures and the time necessary for subsequent airing.

In one ship fumigation was carried out for 4 hours, the minimum temperature being 10° C. [50° F.] and the maximum 14·8° C. [about 59° F.]. To test the effect of the gas, rats and mice were used, as well as cockroaches, larvae of the flour beetle [*Tenebrio molitor*, L.], adults and larvae of the flour moth [*Ephestia*], and adults of the grain weevil [*Calandra granaria*, L.], the lard beetle [*Dermestes lardarius*, L.] and bugs [*Cimex lectularius*, L.]. In the hold, where 7·7 oz. ethylene oxide was used per 1,000 cu. ft., the mammals were killed, and the insects died in the 48 hours following the fumigation, whereas in the crew's quarters, where the rate was about 15·8 oz. per 1,000 cu. ft., they died in 24. After airing for 20 hours, 10 per cent. of the ethylene oxide originally liberated was present in various parts of the fumigated space.

In another ship the crew's quarters of which were fumigated for 6 hours with 15·8 oz. per 1,000 cu. ft., all insects were killed except a few bugs and cockroaches, which died within the following 24 hours. After airing for 6 hours, rats and mice were placed in various parts of the fumigated quarters and left for 13 hours. Those in a cabin where the average temperature was about 11·5° C. [52·7° F.] were killed, the concentration of the fumigant having sunk to 3·8 oz. to 1,000 cu. ft., but those in one where the average temperature was about 16·5° C. [61·7° F.] and the concentration had decreased to 2·6 oz. to 1,000 cu. ft. survived. As the average yearly temperature in the harbour of Hamburg does not usually rise above 11·5° C., the authors conclude that 6 hours is insufficient for airing fumigated ships.

In other tests at average temperatures of 3·5° C. [38·3° F.] and 6° C. [42·8° F.], rats and mice survived when kept for 6 hours in cabins during fumigation at the rate of 4 oz. to 1,000 cu. ft., whereas others kept for 12 hours in the same cabins after an airing of 6 hours were killed, though the concentration of ethylene oxide had sunk to 0·1 oz. to 1,000 cu. ft.

From these experiments the authors conclude that ethylene oxide is not suitable for the fumigation of ships, unless a sufficiently long time is allowed for the airing. Temporary use of the fumigated compartments may be permitted only after the concentration of the fumigant is lower than 0·1 oz. to 1,000 cu. ft., and further airing at a temperature of not less than 10° C. is necessary to ensure the complete disappearance of the gas.

PAPERS NOTICED BY TITLE ONLY.

HECHT (O.). **Ueber den Wärmesinn der Stechmücken bei der Eiablage.** [On the Thermotropism of ovipositing Mosquitos.]—*Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930*, pp. 26–29, 8 refs. Berlin, 1931. [*Cf. R.A.E.*, B, xix, 142.]

BUCHMANN (W.). **Die Bedeutung der Wasserstoffionenkonzentration für die Entwicklung der Mückenlarven.** [The Significance of the Hydrogen-ion Concentration for the Development of Mosquito Larvae.]—*Verh. deuts. Ges. angew. Ent., 8. Mitgliederversamml. Rostock Aug. 1930*, pp. 84–87. Berlin, 1931. [*Cf. R.A.E.*, B, xix, 241].

RITCHER (P. O.). **An undescribed Species of Simuliid Larva** [from Illinois] **and the corresponding Pupa (Diptera: Simuliidae).**—*Ent. News*, xlii, no. 9, pp. 241–246, 1 pl., 15 refs. Philadelphia, Pa., November 1931.

KRÖBER (O.). **Dreizehn neue neotropische** *Tabanus***arten.** [13 new Neotropical Species of *Tabanus*.]—*Konowia*, x, pt. 4, pp. 291–300. Vienna, 1st December 1931.

EWING (H. E.). **A Catalogue of the Trombiculinae, or Chigger Mites, of the New World, with new Genera and Species and a Key to the Genera.**—*Proc. U.S. Nat. Mus.*, lxxx, art. 8, no. 2908, 19 pp., 3 pls. Washington, D.C., 1931.

HOEPPLI (R.) & FENG (L. C.). **Histological Reactions in the skin due to Ecto-parasites,** *Dermacentor sinicus* **P. Schulze from Hedgehog,** *Haemaphysalis campanulata hoeppliana* **P. Schulze from Dog,** *Cimex lectularius* **and** *Pediculus vestimenti* [*humanus*] **from Man.**—*Nat. Med. J. China*, xvii, no. 4–5, pp. 541–556, 4 pls., 16 refs. Peiping, 1931.

KHAW (O. K.). **Transmission of Kala-azar to Hamsters** (*Cricetulus griseus*) **by feeding them with infected Carcasses.**—*Nat. Med. J. China*, xvii, no. 4–5, pp. 599–616, 31 refs. Peiping, 1931.

BODENHEIMER (F. S.). **Erfahrungen über die Biologie der Hausfliege** (*Musca domestica* **L.**) **in Palästina.** [Experiences on the Biology of the House-fly in Palestine.]—*Z. angew. Ent.*, xviii, no. 3 pp. 492–504. Berlin, 1931.

The first section of this paper deals with the bionomics of *Musca domestica*, L., at a small settlement at the point where the Jordan flows into Lake Tiberias, with average temperatures of 25° C. [77° F.] in May, 28° C. [82·4° F.] in June, and 30° C. [86° F.] in July. A detailed description is given of the various breeding-places, stables being the chief source of flies in dwelling houses. To obtain biological data, a kerosene tin was two-thirds filled with cow-dung and left uncovered for a day, after which it was covered with gauze and counts of the emerged adults were made daily. The emergence curve had two peaks, on the 10th and 12th days, the main emergence extending from the 9th to the 14th. Emergence on the 8th and up to the 22nd day was observed occasionally. The experiments cause the author to revise the development curve for *M. domestica* given in a previous paper [*R.A.E.*, B, xiii, 33]. The critical cold point is 5° C. [41° F.], and the thermal constant 300. The temperature of the manure governs development, and records of the duration of the various stages show that the life-cycle in mid-summer may be completed in a minimum of about 10 days, with probably 20 generations a year. All fly breeding sources should therefore be removed from the vicinity of dwellings at least once a week.

The foregoing results were confirmed by observations and breeding experiments in the coastal plain of Palestine. A decrease in the numbers of flies in the heat of summer is explained by the fact that the temperature in the top 8-inch layer of manure heaps, which is of chief importance in fly production, rose above the absolutely fatal height of 60° C. [140° F.]. In winter the minimum temperature in fresh manure was 18–19° C. [64·4–66·2° F.], and there is continuous fly production. In the open these broods are destroyed by the winter rains, though they survive where sheltered. Tables are given of the observed temperatures and development times, showing that the number of generations is not less than that at the northern point of Lake Tiberias.

In general it would appear that there were no clearly defined factors limiting the adults. All breeding-places had in common a great humidity (at least at the time of oviposition), and a certain degree of warmth. This last factor is unimportant in the hot summer of the tropics and sub-tropics, as environmental heat supplies the needed stimulus, but in cooler regions accumulations of organic matter are essential for the mass development of *M. domestica*. Even at the present day the actual food of the maggots is unknown, but certain fermentative processes appear to contribute to the suitability of breeding-places, both in attracting the ovipositing females and in providing food for the larvae.

DE MEILLON (B.). **Report of the Department of Entomology.**—*Ann. Rep. S. Afr. Inst. Med. Res. 1930*, pp. 29–32, 5 refs. Johannesburg, 1931.

Xenopsylla versuta, Jord., is recorded, for the first time from South Africa, on a striped mouse (*Rhabdomys pumilio*) in Bechuanaland.

(22648) Wt P2/3550 1,600 2/32 H & Sp Gp 52

Anopheles funestus, Giles, was taken in native huts filled with smoke, thus upsetting a widespread belief in the value of wood-smoke as a fumigant. Pools containing *Lemna minor* and *Wolffia arrhiza* were free from Anopheline larvae, whereas adjacent pools that did not contain these plants harboured larvae, including those of *A. gambiae*, Giles. Such plants form a dense growth on the surface and prevent the siphons of the larvae from coming into contact with the air, thus causing asphyxiation. An apparently fully grown larva of *Oestrus ovis*, L., is recorded from human faeces. It is probable that the larva was originally deposited in the entrance to the nostrils and subsequently passed into the intestines.

DE BUEN (E.). **Algunos estudios sobre biologia del** *Anopheles maculipennis* **en lo que se refiere a la casa habitada por el hombre o animales.** [Some Studies on the Biology of *A. maculipennis*, as regards Dwellings and Animal Quarters.]—*Med. Países cálidos*, iv, no. 5, pp. 400–414, 5 graphs. Madrid, September 1931. (With a Summary in French.)

In investigations on *Anopheles maculipennis*, Mg., in the province of Cáceres, Spain, it was found that the larvae from eggs deposited by the overwintered adults occur in water near dwellings and animal quarters. In summer, however, when animals are kept in the fields and many people leave their homes to stay in the open country, the larvae occur in any suitable breeding-place. Adults usually enter shelters in order to feed, remain there to digest food and mature the eggs, and leave to oviposit. Owing, however, to different conditions in dwellings, they often do not remain there so long as in animal quarters. Some come back to their former shelters. In the coldest and hottest months there is a decrease in the numbers of adults leaving shelter, and when the temperature is very low they do not leave at all. Although they usually bite indoors, they may also do so in the open.

HEYDON (G. M.). **Some common Queensland Mosquitoes as intermediate Hosts of** *Wuchereria bancrofti* (*Filaria bancrofti*).—*Parasitology*, xxiii, no. 4, pp. 415–427, 19 refs. Cambridge, November 1931.

From experiments in which mosquitos were fed on the blood of man infected with *Filaria* (*Wuchereria*) *bancrofti* in North Queensland [*cf. R.A.E.*, B, xvi, 93], it is concluded that *Anopheles amictus*, Edw., is a favourable intermediate host of the parasite, comparable but not quite equal to *Culex fatigans*, Wied. *Aëdes vigilax*, Skuse, is not a favourable host, and *Culex sitiens*, Wied., is even less so, although infective larvae develop in some individuals. Filarial larvae failed to develop in any of the 62 individuals of *Aëdes argenteus*, Poir., tested.

During 1921–24 many observations were made on the mosquitos of Rabaul, New Britain [xii, 38, 48]. *C. fatigans* was found in many houses in the town, but was only seen occasionally in certain adjacent villages. *Aëdes variegatus*, Dolesch., was numerous in many parts of New Britain and was more abundant than any other mosquito on verandahs at Rabaul during the day, although it was never caught biting at night. *A. argenteus* was not plentiful, although larvae could easily be obtained in containers placed on verandahs. *A. kochi*, Dön. (or a variety of this species) bred commonly near Rabaul in the water that collects in the axils of the leaves of *Pandanus* and bananas. The young larvae could not be reared in the laboratory in the water used for any other species. These habits appear to agree with those of *A. kochi* var. *samoana*, Grünb., rather than with those of the typical form ; the latter was, however, taken by Hill [xiii, 145] breeding in split coconut shells.

André (E.). **Sur la Piqûre du** *Nabis apterus*.—*Parasitology*, xxiii, no. 4, p. 445. Cambridge, November 1931.

The author records a case of the Reduviid, *Nabis apterus*, F., biting man during the night in the Canton of Berne, Switzerland.

Hoare (C. A.). **Studies on** *Trypanosoma grayi*. **III. Life-cycle in the Tsetse-fly and in the Crocodile.**—*Parasitology*, xxiii, no. 4, pp. 449–484, 4 pls., 2 figs., 2 pp. refs. Cambridge, November 1931.

This investigation was carried out in London, on material collected in Uganda in 1927–29 during experimental work on the transmission of *Trypanosoma grayi* [*R.A.E.*, B, xvii, 185].

The following is taken from the author's summary :—An account is given of the life-cycle and morphology of *T. grayi* in the crocodile (*Crocodilus niloticus*) and in *Glossina palpalis*, R.-D. The immunological relations of this trypanosome to its hosts and its affinities to other species are also dealt with. When fed on an infected crocodile, the fly takes up not more than about six trypanosomes. These commence their development in the mid-gut, giving rise to crithidial and trypanosome forms, and later extend to the hind-gut, where their evolution is completed and the infective metacyclic trypanosomes are produced. These, when voided with the faeces, infect the crocodile by the mouth. The distribution of *T. grayi* in the gut of the fly in the course of its development is determined by the presence of the peritrophic membrane and involves migration from the intraperitrophic space backwards into the colon, then forwards into the extraperitrophic space, up to and including the mid-gut, and finally backwards to the hind-gut.

The average infection rate in experimental flies is 61 per cent. in the early days of infection, but later falls to 17·3 per cent. The majority of flies appear to acquire an immunity after the fifth day. The average degree of infection in wild flies is 11·2 per cent. This closely approximates to that in experimental flies, and it is therefore inferred that the majority of the wild flies had fed in nature on infected crocodiles.

The name *Trypanosoma theodori*, sp. n., is proposed for the goat trypanosome described by Theodor [xvi, 164 ; xviii, 11], which is carried by *Lipoptena caprina*, Aust., in Palestine.

Coatney (G. R.). **On the Biology of the Pigeon Fly,** *Pseudolynchia maura* **Bigot (Diptera, Hippoboscidae).**—*Parasitology*, xxiii, no. 4, pp. 525–532, 12 refs. Cambridge, November 1931.

The Hippoboscid, *Pseudolynchia maura*, Big., is cosmopolitan in its distribution, and its natural host is the domestic pigeon. Experiments are described in which flies were fed in the laboratory on pigeons, fowls, doves and man, and observations on its biology, pupa and pupation period, sex ratio, offspring per female and longevity are recorded. It would appear that poultry and doves are as suitable hosts as pigeons, and it is not known why these birds do not naturally harbour the flies.

Daubney (R.) & Hudson (J. R.). **Nairobi Sheep Disease.**—*Parasitology*, xxiii, no. 4, pp. 507–524, 6 charts, 1 ref. Cambridge, November 1931.

During the course of investigations on heartwater, this disease was compared with Nairobi sheep disease [*R.A.E.*, B, v, 76], with which it has been confused. The experiments described completely confirm Montgomery's findings [*loc. cit.*] as to the specificity of Nairobi sheep disease and its transmission by *Rhipicephalus appendiculatus*, Neum. Transmission by adults infected as nymphs and by larvae infected through the egg from adult females was also confirmed and, in addition, transmission by nymphs infected as larvae was obtained. Infection in the vector is retained to the next succeeding stage only. If, however, the incubation period of the disease in the sheep is so short that the temperature reaction begins before the transmitting tick has finished its feed, some infective blood is taken into the gut of the latter and it is again infective in the next instar. Up to the present this is the only filtrable virus disease in which the virus has been proved to pass in the vector from the adult to the larval stage through the egg. Infective ticks fed on an immune animal are still infective by inoculation when they drop fully engorged, but their infecting power is lost some time before they are ready to feed again. The virus in ticks infected in the previous stage appears to be confined to the salivary glands ; after the transmitting feed, whether on an immune or susceptible animal, the salivary gland infection dies out, probably during the moult ; a fresh infection of the newly formed glands will, however, take place if a fresh infection of the gut contents occurs.

A possible reason why the disease has failed to attract attention in Kenya during the last few years is the change in the fat sheep trade in Nairobi. Formerly, comparatively large numbers of native sheep, many of which had been bred in areas free from infestation with *R. appendiculatus*, were collected in and around Nairobi and kept on infected pastures until they could be absorbed by the market. Now the sheep are largely brought by rail or car and slaughtered immediately. There does not appear to be any abatement in the incidence of the disease in the infected reserves near Nairobi, but in such areas sheep are attacked during the first year of life and either succumb to infection or acquire a lasting immunity. It is pointed out that the Colony can be divided into certain quite sharply delimited areas in which African coast fever and *R. appendiculatus* are present, and other areas in which both disease and tick are normally absent. In the former, all adult cattle are immune from African coast fever and practically all adult sheep and goats are equally immune from Nairobi sheep disease. Comparison with a soil map shows a striking agreement between the extent of the infested areas and the chocolate forest-loam formation, *R. appendiculatus* being the preponderating tick only on the chocolate loam. Another tick with an almost equal predilection for a particular soil formation is *R. pulchellus*, Gerst., which is found in the plains and thrives particularly on black cotton soil, where it is always the predominant species.

WALKER (J.). **Annual Report of the Chief Veterinary Research Officer for the Year 1930.**—*Ann. Rep. Dept. Agric. Kenya 1930*, pp. 95–188. Nairobi, 1931.

In a paper on African coast fever (pp. 100–108), the author points out that a certain percentage of the cattle that react to inoculations conferring artificial immunity from the disease are incompletely protected, and in these cases it is essential that they should be exposed to natural infection by means of infected ticks. This is not always possible, and experiments were undertaken to determine whether inoculation with an emulsion of infected ticks or artificial infestation of the ears with infected ticks could be substituted. The latter method was found to produce a reaction in every case when batches of 50 or more ticks were used. It is suggested that further experiments should be undertaken to determine whether emulsions using larger numbers of infected ticks (50 or more) would invariably produce a reaction.

During work on *Rhipicephalus appendiculatus*, Neum., in connection with Cowdry's investigations [*R.A.E.*, B, xix, 35], it was observed that transmission of *Theileria parva*, *T. mutans*, *Piroplasma bigeminum*, *Anaplasma marginale* and spirochaetes does not occur through the egg.

E. A. Lewis in a paper entitled " Report on Tick Survey in Kenya Colony " (pp. 151–162) gives a list of the species and varieties of ticks found in Kenya [*cf. R.A.E.*, B, xix, 177], of which ten are believed to be recorded for the first time. Of the latter, only two, *Hyalomma aegyptium dromedarii*, Koch, and *H. aegyptium impressum*, Koch, were found on cattle. The importance of various species in the transmission of disease is discussed [*loc. cit.*]. Brief summaries are given of detailed investigations on ticks carried out in certain districts of Kenya [*cf.* next paper].

Other papers of entomological interest are " Enzootic Hepatitis, or Rift Valley Fever " (pp. 113–126) and " Nairobi Sheep Disease " (pp. 127–132) both by R. Daubney and J. R. Hudson, which have already been noticed from more detailed accounts [see preceding paper and xix, 207].

LEWIS (A. E.). **A Study of the Ticks in Kenya Colony. The Influence of natural Conditions and other Factors on their Distribution and the Incidence of Tick-borne Diseases. Part I. A Report on an Investigation into the Tick Problem in the Rift Valley, Kenya Colony.**—*Bull. Dept. Agric. Kenya*, no. 17 of 1931, 19 pp., 1 map. Nairobi, 1931.

A detailed investigation is being undertaken on the ticks occurring in Kenya Colony and the relation of such factors as climate, topography, soils, etc., to their distribution, as a basis for research on the incidence of tick-borne diseases. The results will be published in a series of reports of which the present paper, dealing with the Rift Valley and certain adjacent districts, is the first.

A total of 23 species of ticks belonging to six genera was collected. *Rhipicephalus bursa*, C. & F., *R. evertsi*, Neum., *Boophilus annulatus decoloratus*, Koch, and *Haemaphysalis leachi*, Aud., are generally distributed. Species of *Hyalomma* occur commonly and abundantly in districts where the soil is porous and light, but were not found at altitudes above 8,000 ft. *H. aegyptium dromedarii*, Koch, was only found on one farm on the border of the Masai Reserve. *Amblyomma variegatum*, F., is no longer found in large numbers, dipping having apparently reduced its numbers considerably. It is usually confined to the lower districts and to light volcanic soil, but may be found at about 7,000 ft. Species of *Rhipicephalus* occur on all soils. On the Kinangop plateau, frosts are experienced in dry weather, vast areas become water-logged during the rains and, owing to the sparseness of vegetation, the soil is often exposed to the sun and winds, and it seems probable that a combination of these factors accounts for the absence of *R. appendiculatus*, Neum., and some other species, though not affecting more resistant ones, such as *R. evertsi*, *B. annulatus decoloratus* and *H. leachi*. Even in localities where conditions appear to be more favourable, *R. appendiculatus* is scarce, and it seems probable that its rarity and the apparently peculiar outbreaks of African coast fever in these districts may more easily be explained by the manner in which dipping is practised than by natural factors. On the first appearance of the disease, dipping and hand-dressing of cattle are begun, but are only continued until the disease appears to have been arrested, sometimes within a few months. If another death occurs, dipping may again be resorted to, but by this irregular method neither the tick nor the disease is thoroughly controlled. Re-infestation may therefore be the result of relaxation of treatment before all the ticks, infected and non-infected, are exterminated, of infection brought in by straying stock or game, or of a combination of these factors. Species of *Ixodes* were collected mainly from the slopes of the lesser scarps, but no disease transmitted by species of this genus is known to occur in this region. The distribution of *B. annulatus decoloratus* has undoubtedly been affected by dipping, and where fairly regular dipping is practised, no individuals were obtained. In some cases anaplasmosis of cattle is common in areas where this tick is absent or rare, but usually *R. evertsi* or some other possible vector of the disease is present. Antipathy to dipping against *B. annulatus decoloratus* is due to the fact that uninfested cattle are susceptible to anaplasmosis and piroplasmosis. In spite of this, continuation of efforts to eradicate ticks are recommended, and it is suggested that artificial inoculation against piroplasmosis and anaplasmosis should be adopted.

Troisier (J.), Cattan (R.) & Sifferlen (—). **Fièvre exanthématique inapparente de l'homme transmise par** *Rhipicephalus sanguineus*, **virulence pour le singe et le cobaye.**—*Ann. Inst. Pasteur*, xlvii, no. 5, pp. 492–507, 6 figs., 2 refs. Paris, November 1931.

Among the exanthematic fevers of man is one [Marseilles fever] observed in the south of France, Tunis and Greece, which has been experimentally produced by inoculation of crushed individuals of the dog tick, *Rhipicephalus sanguineus*, Latr. [*cf. R.A.E.*, B, xviii, 189; xix, 38]. The guineapig has been considered resistant, and this fact, together with cross-immunity reactions and difference in vectors [*cf.* xvii, 62], led to the conclusion that this fever was distinct from exanthematic typhus. About 60 adult ticks, of both sexes, taken in the second and third week in April from a young dog in a locality in the department of Var, where no case of exanthematic fever had been known to occur, were emulsified and inoculated beneath the skin of a man. None of the usual symptoms were observed though Weil-Felix reactions were positive. This type of infection without fever or eruption is the exact replica of the "inapparent" typhus of C. Nicolle. Subinoculations produced a similar "inapparent" disease in man, a disease characterised by fever alone in guineapigs (in which animals Weil-Felix reactions were always negative), and in monkeys symptoms that were either typical or consisted of fever alone, eruption alone or simply a positive Weil-Felix reaction. The cutaneous lesions in monkeys are identical with those of Marseilles fever in man. The behaviour of this virus in man, monkey and guineapig shows a relationship between the exanthematic fever carried by *R. sanguineus* and typhus.

COMBIESCO [D.]. **Sur une épidémie de fièvre exanthématique (fièvre boutonneuse ou fievre escharo-nodulaire) observée à Constantza.**—*Bull. Off. int. Hyg. publ.*, xxiii, no. 11, pp. 1979–1984, 2 graphs. Paris, November 1931.

This preliminary account of an outbreak of exanthematic [Marseilles] fever at Constantza, Rumania, is communicated by J. Cantacuzène. Enquiry revealed that only 11 cases had been observed by local doctors during the preceding 20 years. The outbreak began towards the end of July 1931 and up to 15th September 31 cases had occurred. In 27 of these, dogs inhabiting the same premises were found to harbour numerous ticks, chiefly *Rhipicephalus sanguineus*, Latr., but also a few individuals of *Ixodes ricinus*, L. Two men inoculated with an emulsion of crushed ticks (*R. sanguineus*) from the dogs developed the disease, but inoculations into rabbits gave negative results. The characters differentiating this disease from exanthematic typhus are discussed.

DE LA TORRE (I.). **Sur l'onchocercose au Mexique.**—*Bull. Off. int. Hyg. publ.*, xxiii, no. 11, pp. 2017–2020. Paris, November 1931.

An account is given of onchocercosis (caused by *Onchocerca caecutiens*) in Mexico [*cf. R.A.E.*, B, xviii, 271, etc.]. The campaign organised for the control of the disease includes measures to prevent the breeding of Simuliids.

MARTOGLIO (F.). **La fièvre récurrente africaine.**—*Giorn. Med. milit.*, lxxix, fasc. 1–2, p. 53. Rome, 1931. (Abstract in *Bull. Off. int. Hyg. publ.*, xxiii, no. 11, p. 2037. Paris, November 1931.)

This is a detailed review of African relapsing fever caused by *Spirochaeta duttoni* and transmitted by *Ornithodorus moubata*, Murr., and sometimes by *O. savignyi*, Aud. The distribution of the disease, which covers the greater part of the continent of Africa, is indicated. The results of a microbiological study of the parasite are given, with a description of its life-cycle and its transmission from the invertebrate host to man and animals. In exceptional cases experimental transmission has been obtained with *Stomoxys calcitrans*, L., *Cimex*, and *Polyplax* (*Haematopinus*) *spinulosa*, Burm. The chief measures of control for use in endemic areas are outlined.

ZINSSER (H.) & CASTANEDA (M. R.). **Studies on Typhus Fever. VIII. Ticks as a possible Vector of the Disease from Animals to Man.**—*J. Exptl. Med.*, liv, no. 1, pp. 11–21, 6 charts, 5 refs. New York, 1st July 1931.

In continuation of studies on the mode of transmission of Mexican typhus fever [Brill's disease] [*cf. R.A.E.*, B, xix, 116], experiments were undertaken with *Dermacentor nitens*, Neum., *D. venustus*, Banks (*andersoni*, Stiles) and an undetermined species of *Amblyomma*. The ticks were injected *per rectum* with infected material from guineapigs. It was found that the virus remained alive and potent for at least 12 days, and that guineapigs injected with the viscera of such ticks developed symptoms typical of Mexican typhus. Two experiments in which dogs were injected with infected material from guineapigs failed to show that these animals could contract the disease or harbour the virus in an " inapparent " form, and rats and mice are more likely to be the reservoirs.

DE BEAUREPAIRE ARAGÃO (H.). **Notas sobre os** [Notes on] *Ornithodoros rostratus, brasiliensis* **e** *turicata.*—*Mem. Inst. Oswaldo Cruz*, xxv, no. 3, pp. 227–231, 1 pl., 4 refs. Rio de Janeiro, August 1931. (Also in English, pp. 232–236.)

Descriptions are given of *Ornithodorus rostratus*, Aragão, *O. brasiliensis*, Aragão, and *O. turicata*, Dugès, in order to show clearly their specific differences.

OLENEV (N. O.). **Die Zecken (Ixodoidea) der Fauna Russlands.** [The Ticks of Russia.]—*Z. Parasitenk.*, iv, no. 1, pp. 126–139, 32 refs. Berlin, 4th December 1931.

A list of the Ixodoidea of the Russian Union is given, showing their distribution in other countries. Keys to the species of *Dermacentor*, with a new subgenus, and of *Ornithodorus*, with a new species, *O. tartakovskyi* from Uzbekistan, are included and three new species of *Hyalomma* are described.

[EL'MANOV (N. V.).] **Ельманов (Н. В.). On the Biology of** *Ixodes ricinus*, **the Tick Transmittor of the Piroplasmosis of Cattle.** [*In Russian.*]—*Prakt. Vet.*, no. 5–6. [Moscow] May–June 1930. (Abstract in *Plant Protection*, vii (1930), no. 1–3, p. 193. Leningrad, 1931.)

The important part played by the tick, *Ixodes ricinus*, L., in the transmission of piroplasmosis of cattle in north-western Russia is discussed, and an account of its bionomics is given. The adults overwinter on the ground under the cover of moss, fallen leaves and débris, and in the spring are found waiting on the stems of grasses and small bushes in order to attach themselves to grazing animals ; low lying and damp pasture land, covered with shrubs, is usually heavily infested. Under laboratory conditions the life-cycle was completed within a period varying from 6 months to about 5 years (180–1874 days).

[DEGTYAREV (—).] **Дегтярев (—). The Warble Fly and its Control.** [*In Russian.*]—*Prakt. Vet.*, no. 2–3. [Moscow] 1930. (Abstract in *Plant Protection*, vii (1930), no. 1–3, pp. 193–194. Leningrad, 1931.)

A brief account of the biology and control of the warble flies [*Hypoderma*] of cattle in the Russian Union and elsewhere is given. The loss caused to the leather trade in Russia is roughly estimated at about a million sterling, and infestation is also responsible for a considerable decrease in the yield of milk and a deterioration in the quality of the meat. Observations have shown that dressing infested cattle with tar or crude oil has an unfavourable effect on their condition. Injections of carbon tetrachloride killed 96 per cent. of the larvae of the fourth and fifth instars.

HIRST (L. F.). **Report on the Protection of the Interior of Ceylon from Plague, with special Reference to the Fumigation of Plague-suspect Imports.**—*Rep. Med. Off. Hlth. Colombo 1930*, xxv, pp. 46–92, 2 pls., 4 maps, 2 diag., 8 graphs, 45 refs. Colombo, 1931. Also separately published.

Much of the rice imported yearly into Ceylon from Burma is consigned to estates in the hill country between 1,500 and 5,000 ft. above sea level, where climatic conditions are favourable to the spread of plague and *Xenopsylla cheopis*, Roths., is well established on rats [*cf. R.A.E.*, B, xix, 15], and there is thus a danger that plague will eventually establish itself in the highlands. This is more especially the case as the natural barrier to the spread of the disease that appears to exist in the lowlands in an unmixed flea population of *X. astia*, Roths., on *Mus* (*Rattus*) *rattus*, with an index (2–5 per rat) probably inadequate to maintain plague among domestic rats, seems to be becoming less and less effective, owing to the establishment of *X. cheopis* on rats in bazaars and mills containing imported cotton and grain [*cf.* xviii, 121].

The mode of transport of plague infection is discussed. Bubonic plague is primarily a disease of rodents carried by fleas. So far as maritime commerce is concerned, the rat is the important rodent, and for all practical purposes, the presence of fleas in sufficient numbers is essential for the continuous spread of the disease. Man may act as a carrier of fleas, or under exceptional purposes may infect them, but a man infected with bubonic or septicaemic plague is not a source of danger once he has been freed of fleas, unless he develops pneumonia. The danger of any particular kind of merchandise acting as an agent in the spread of plague is proportionate to the extent to which it is or has been infected with rats and fleas. Grain is the most important vehicle of infection, since it is the favourite food of rats, and its débris forms a suitable diet for the larvae of plague-carrying fleas [xv, 223]. For this reason, free access to grain leads to an increase in the numbers of rats and fleas and to conditions favouring a rat epizootic, particularly as the average number of fleas per rat tends to increase when rats are aggregated together in unprotected granaries. A rat usually dies within a week of being bitten by an infected flea. As a rule only some of the fleas infected after feeding on an infected rat can transmit the disease, and such fleas live only a short time in hot or dry air, though in a cool moist atmosphere they may live for weeks. Evidence indicates that when an overseas source of infection is only a few days removed, an infected flea may readily be transported from the port of origin to the port of entry; otherwise, it may be inferred that a plague epizootic has occurred among the rats on board ship. The link between the ship epizootic and the shore rats, or the rats on the lighter into which the grain is unloaded, may be a rat but is more likely to be a flea. At Colombo the mooring of ships away from the quay and the use of lighters must considerably reduce the importation of rats. It appears that the spread of plague is usually the result of the passive transference of rats and fleas in merchandise. If, however, plague becomes established among true field rodents, their movements become the most important factor in the spread of the disease.

In such goods as cotton, gunny bags, rags and hides, infection may be regarded as almost exclusively flea-borne; the only premises on the outskirts of both Colombo and Madras [*cf.* next paper] in which *X. cheopis* is found in large numbers on rats are mills using much cotton imported from areas where this flea is prevalent. Bombay and Rangoon are the external sources of plague that are of the greatest concern to Ceylon, but the plague season in the former is from March to April and in the latter from February to April, with the possibility of a second wave in June-August, whereas plague is most prevalent in Colombo from the beginning of November to the end of February. The maximum incidence of plague among rats, which is the chief factor governing the exportation of plague, takes place some weeks earlier. The rats and the flea-index of Rangoon are discussed, together with the conditions obtaining in the grain export mills and stores and in the grain lighters, and the results of a rat-flea survey of grain ships entering the Port of Colombo are summarised [*cf.* xix, 14]. The rats on the lighters in the harbour of Colombo are kept down by fortnightly fumigations with sulphur dioxide. The majority of the rats on these boats are of local origin and are not derived from ships.

The qualities necessary in a fumigant used for plague preventive purposes are discussed. In an experiment adults and larvae of *X. astia* were exposed to a mixture of hydrocyanic acid gas and air at a mean concentration of 20 : 100,000, drawn through a 4-litre jar at the rate of 4 litres in 13 minutes. All larvae were quiescent in 8 minutes, and all adults in 9, though a few adults subsequently revived. The extreme susceptibility of *X. astia* and *X. cheopis* to this gas does not appear to have been generally realised; they are much less resistant than rice weevils. It appears to be commonly accepted that complete destruction of fleas in bagged grains and similar permeable products is scarcely practicable without a vacuum to assist the penetration of the HCN, but experiments demonstrated that, given an adequate concentration of the gas in the air surrounding individual bags and a sufficiently long exposure, the complete disinfestation of large or medium sized grains, including the chief varieties of rice sold in the Eastern market, is quite practicable and does not injure the grain. A somewhat prolonged ventilation is subsequently necessary to eliminate the fumes. Numerous experiments were undertaken to test the penetrative power of HCN into bagged substances, particularly rice and other grain infested with rat-fleas, and its lethal action on rat-fleas buried at different depths in grain. Eggs, larvae, and adults buried in the centre of sacks of rice can be killed by exposing isolated sacks for 40 minutes to a forced draught of air at tropical temperature (about 82° F.), impregnated with approximately 2 oz.

HCN per 1,000 cu. ft. (standard U.S. concentration). When the bags are wetted, a similar result can be obtained by moderately increasing the concentration of the gas. With fine grains, however, effective penetration is not obtained, even in one hour with concentrations such as 150–200 parts per 100,000. For practical plague preventive purposes it would seem sufficient to aim at a concentration that will turn benzidine copper acetate test paper blue at a depth of 6 inches. Experiments showed that such a result may be obtained with isolated bags exposed in a canvas tunnel for half an hour to a continuous blast of air containing 2 oz. HCN to 1,000 cu. ft.

A comparative table shows the superiority of HCN over sulphur dioxide for the fumigation of ships; the latter is only really effective in empty holds. It is the customary practice to fumigate goods in lighters rather than in the holds of ships. Experiments with HCN in lighters confirmed the lethal effect of the gas on rat-fleas buried at various depths in the bags of grain. Instructions are given for the fumigation of warehouses, and a successful fumigation, using HCN discoids, is briefly described. The economic aspects of various methods for the treatment of grain in ships, lighters and warehouses are discussed, and practical suggestions are made for disinfecting several lighters at one time and for fumigating in a specially constructed conveyor (based on data obtained in the canvas tunnel experiments), in which the bags of grain are transported without interruption from lighter to warehouse in a stream of cyanide gas.

King (Harold Holmes) & others. **A Rat-flea Survey of the Madras Presidency. Reports I-III.**—*Ind. J. Med. Res.*, xvii, pp. 297–334, 4 maps; **Reports IV-VI.**—*T.c.*, pp. 1223–1257, 2 maps; **Reports VII-XIII.**—*Op. cit.*, xviii, pp. 727–783. Calcutta, 1929–31.

King (Harold Holmes) & Pandit (C. G.). **A Summary of the Rat-flea Survey of the Madras Presidency with a Discussion on the Association of Flea Species with Climate and with Plague.**—*Op. cit.*, xix, pp. 357–392, 14 maps, 1 chart, 7 refs. Calcutta, October 1931.

In the course of the second paper, which is an extensive summary of reports on about 30 local rat-flea surveys in the Madras Presidency begun in September 1928, the authors discuss the geography of Peninsular India and its effect on local climate, the distribution of rodents and fleas, the influence of the cotton trade on the distribution of *Xenopsylla cheopis*, Roths., the effect of seasonal changes on the prevalence of fleas, and the associations between the distribution of fleas and climate and between the species of fleas and plague.

Xenopsylla astia, Roths., appears to be sufficiently widespread to be called indigenous, whereas *X. cheopis* seems to have been introduced comparatively recently and to be still in the process of spreading. The incrimination of grain in the transport of fleas is confirmed, and the great importance of cotton in this connection is emphasised, particularly with reference to the spread of *X. cheopis*. *X. brasiliensis*, Baker, appears to be established in the Mysore Plateau and similar adjacent areas, but in the absence of an extended survey of this area, it is not known whether or not it is indigenous.

There is a marked association between the distribution of *X. cheopis* and climate, and a similar marked association between the distribution of this species and plague. Evidence indicates that this is not due to an association of plague with climate apart from flea species, for in some places where *X. cheopis* is absent there has been little or no human plague in spite of favourable climatic conditions and the occasional presence of plague infection, as shown by both human and rat plague. Moreover, in the typical *astia* zone of the south-east plain, the climate in the cool weather is eminently suitable for the propagation of plague, which does not occur, despite flea indices sufficiently high to cause epidemics if they referred to *X. cheopis*, a rat population that is particularly susceptible to infection, and the continuous introduction of infection through the important trade centres. Thus it is concluded that in South India the flea species factor is of the first importance in the spread of plague under natural conditions and that *X. cheopis* is the important vector.

The region least suited to *X. cheopis* is the central and southern part of the east-coast plain, where the climate prolongs conditions unfavourable to this species of flea. In this eastern region the hot weather, instead of ending in June with the commencement of the south-west monsoon, continues into September, largely because most of the rain has been intercepted by the continental plateau before reaching the coastal plain.

The occurrence and severity of plague epidemics are associated with the numbers of *X. cheopis* present. Where *X. astia* acts as a vector in nature in the absence of *X. cheopis* in South India, the epidemics are small and few, and the infection is not carried over from one season to the next. This fact suggests that the plague bacillus survives in the rat-flea rather than in the rat. The scanty data on *X. brasiliensis* suggest that this flea is as efficient a vector as *X. astia*, and the fact that in one locality the mortality among rats was quite out of proportion to the few deaths in man, tends to indicate that although the species of flea responsible (*X. astia*, *X. brasiliensis*, or both) readily transmits plague to rats, it is not such an efficient vector to man. *Ceratophyllus nilgiriensis*, Jord. & Roths., is probably associated with *X. cheopis* in the transmission of plague in the Nilgiri Hills.

WALKER (J. N.), CHENOY (C. F.) & RAO (S. R.). **Rat-flea Survey of the City of Hyderabad (Deccan).**—*Ind. J. Med. Res.*, xix, no. 2, pp. 657–673, 2 maps. Calcutta, October 1931.

Plague first appeared in Hyderabad in 1911, and since 1924 it has recurred every year. In a rat-flea survey of the city, made from September 1929 to March 1931, a total of 317,744 rodents were caught, the rat density being highest in the grain markets. Of the 13,746 fleas collected on rats, 12,949 were *Xenopsylla cheopis*, Roths., 794 *X. astia*, Roths., 2 *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., and 1 *Ceratophyllus fasciatus*, Bosc. The flea-index was highest during the months of September and October (6·4 and 6·2 respectively) when the mean maximum temperature fell to 88° F. and the humidity reached its maximum for the year (80). This rise in the flea-index has always coincided with the plague epidemic. During April, May and June, the temperature is high, the mean atmospheric humidity very low and the flea-index small; these conditions coincide with the cessation of plague.

Iyengar (M. O. T.). **The Distribution of** *Anopheles ludlowii* **in Bengal and its Importance in malarial Epidemiology.**—*Ind. J. Med. Res.*, xix, no. 2, pp. 499–524, 2 pls., 4 maps, 1 chart, 5 refs. Calcutta, October 1931.

Investigations have shown that *Anopheles ludlowi* var. *sundaica*, Rodenw., is much more widely distributed in Bengal than was previously supposed and that in many areas it occurs in large numbers. It breeds in brackish water and is usually found near the sea-coast, though in Bengal it has been observed as much as a hundred miles inland, mostly on the banks of tidal rivers. The intense breeding of this species in small areas on the banks of the Hooghly and its absence from localities only a few miles distant, together with the fact that it was not previously observed in this region, seem to indicate that it has only recently been introduced, probably through the agency of boats coming up the rivers from areas where it is common. This view is supported by the fact that these areas, which were previously reputed to be healthy, have, during the last few years, become intensely malarious. In the southern part of the district of Khulna known as the Sunderbans, the distribution of this mosquito is more general and extensive [*cf.* *R.A.E.*, B, xviii, 266]. Accounts are given of malaria surveys carried out during epidemics in two areas on the Hooghly, and in each case *A. ludlowi* var. *sundaica*, which showed natural infection rates of 23·4 and 4·2 per cent., was found to be the important vector, although naturally infected individuals of *A. fuliginosus*, Giles, and *A. culicifacies*, Giles, were also observed.

The salinity of 237 samples of water from Anopheline breeding-places in these two areas was determined; the content of sodium chloride varied from 0 to 3,000 mg. per litre, and the percentage of breeding-places in which each species was found for each range of 500 mg. is given. *A. ludlowi* var. *sundaica* is the only Anopheline that shows a positive correlation with the salinity, although *A. fuliginosus* was found in nearly all ranges, even in water containing 2,700 mg. per litre. The presence of organic matter in the water was determined by tests for nitrites, and it was observed that *A. ludlowi* var. *sundaica* bred in all ponds in which a salinity of more than 1,000 mg. was combined with a trace of nitrites, whereas it rarely occurred in waters of equal salinity in which no nitrites were present.

Iyengar (M. O. T.). **The relative Value of the Oöcyst Rate and the Sporozoite Rate in** *Anopheles*.—*Ind. J. Med. Res.*, xix, no. 2, pp. 525–539, 3 charts, 1 ref. Calcutta, October 1931.

The author considers that estimation of the infectivity rate in Anophelines should be based on both gut and salivary gland infections. In cases where, under natural conditions, oöcysts only are observed, an infection rate based on gut infection alone may not represent the transmitting capacity of the mosquito, since it would appear that certain factors, not yet well understood, are preventing the development of the oöcysts. On the other hand, where both gut and salivary gland infections are observed at the same time, often in the same individual, there is no reason to suppose that the oöcysts will not develop and produce sporozoites, and in such cases they should be included in the infectivity rate.

Four series of dissections of *Anopheles ludlowi* var. *sundaica*, Rodenw., were carried out between October 1930 and January 1931 in an area in Lower Bengal where an outbreak of malaria occurred in the autumn of 1930. The total infectivity rate during this period fell gradually from 23·4 to zero; the sporozoite rate dropped rapidly from 20·3 in the first series to 3·7 in the second, and then remained negative; the oöcyst rate rose from 8·5 to 18·5 and then decreased to 14·7 and finally to zero. The author suggests that at the time the first series was collected conditions were favourable for the development of oöcysts and the production of sporozoites. In the case of the second series, although conditions were rather less favourable for the infection of the mosquitos (as indicated by the lower total infection rate) they were still more unfavourable to the development of oöcysts, most of which were only half-grown. The sparse infestations in the salivary glands of two specimens in this series appear to be the remains of previous sporozoite infections. In the third series the presence of oöcysts only indicates that although conditions permitted the formation of oöcysts, they inhibited their development. The absence of any infection in the fourth series would seem to denote conditions unfavourable to the formation of oöcysts.

Analysis of the figures for sporozoite and oöcyst rates, and their ratios to total infection rates, according to the length of time elapsing between the capture of the mosquitos and their dissection, shows that whereas the oöcyst rate steadily decreases owing to lack of opportunity for fresh infection, the sporozoite rate rises until the majority of the oöcysts have matured and subsequently decreases as the sporozoites are gradually eliminated during feeds on the raisins supplied in the cages.

Shortt (H. E.) & Swaminath (C. S.). **Life-history and Morphology of** *Trypanosoma phlebotomi* **(Mackie, 1914).**—*Ind. J. Med. Res.*, xix, no. 2, pp. 541–564, 5 pls., 2 figs., 8 refs. Calcutta, October 1931.

A detailed account is given of the morphology and development of the forms of *Trypanosoma phlebotomi*, Mackie, observed in the wall-gecko, *Hemidactylus frenatus* (which is very common in Assam) and in the sandfly, *Phlebotomus babu* var. *shortti*, Adl. & Thdr. The absence of parasites from the anterior parts of the alimentary canal of the latter precludes transmission by biting, and experiments indicate that lizards are normally infected with *T. phlebotomi* by feeding on infected sandflies.

Roy (D. N.). **The Natural Breeding Habits of** *A. stephensi* **as observed in Calcutta.**—*Ind. J. Med. Res.*, xix, no. 2, pp. 617–628, 4 refs. Calcutta, October 1931.

An account is given of observations on the breeding habits of *Anopheles stephensi*, List., which is the only important malaria vector in the city proper of Calcutta. Larvae in cisterns on the roofs of houses developed in 13–17 days during the dry season and in 10–11 days during the rainy season, provided that there was an abundance of food material floating on the surface. The larval period was prolonged when the available food material was below the surface at depths of 3–5 feet. In temporary breeding pools, larvae pupated after an average of 10–11 days during the dry season and 7–9 days during the rainy season. Experiments in galvanised iron tanks (made to resemble the overhead cisterns) showed that the shallower the water the more rapid was the growth of the larvae. Larvae were unable to withstand any considerable overcrowding in tanks, but, in comparison with their size, rain-water pools may contain very large numbers of larvae and the mortality is lower. Absence of suitable food probably accounts for the difference in mortality in the two situations, for although larvae have been observed to dive to a depth of 3–5 ft., they cannot make use of the abundant food that may lie at this depth, whereas in rain-water pools, which are usually only a few inches deep, all the food material can be utilised. In vats used for soaking bricks, which are frequently exposed to the sun for the entire day, *A. subpictus*, Grassi, predominates, provided that there is shelter for the larvae. On the other hand, *A. stephensi* is more numerous in breeding-places of which only a portion is exposed to the sun for part of the day. During the rains, however, a large number of larvae may be found in cisterns, rain-water puddles, etc., that are exposed to the sun, and in the absence of any apparent food material, can grow rapidly when exposed to the rains; in a receptacle left exposed to the rain the larvae pupated after 8 days, whereas in the laboratory they took 22 days to mature.

Covell has suggested that *A. stephensi* requires fresh water, preferably renewed constantly, and will not breed in foul or stagnant water, but numbers of this species have been taken from stagnant cisterns and larvae have, on many occasions, been found in open earth drains containing foul water, and at times in water contaminated with sewage. On the other hand, his observation that frequent disturbance of the water has no effect on breeding is confirmed. It seems likely that *A. stephensi* is essentially a rainy season mosquito, and that temporary pools appearing at that time are its true habitat. To tide over a critical period such as the dry season, it has adapted itself to entirely different conditions that are much less suitable for its growth.

ROY (D. N.). **On the Ovulation of** *A. stephensi.—Ind. J. Med. Res.*, xix, no. 2, pp. 629–634, 3 refs. Calcutta, October 1931.

Laboratory experiments showed that the average number of eggs laid by single females of *Anopheles stephensi*, List., after one blood meal was approximately the same whether they were fed on rabbit, guineapig or rat, in the dry or rainy seasons, but when fed on man the number in both seasons was reduced to almost half. Eggs left in water for 96–120 hours in a room with a constant temperature of about 11° C. [51·8° F.] all hatched after 12 hours at ordinary room temperature, but exposure to the lower temperature for 164 hours killed all of them. Experiments indicate that the eggs cannot withstand desiccation, except for very short periods. When males and females were confined in cages of different sizes, it was found that the larger the space the greater the number of females impregnated, as pairing takes place in the air. A blood meal appears to be essential not only for the fertilisation of the first batch of eggs, but for each successive batch. It was not possible to keep the mosquitos alive sufficiently long to obtain more than three batches of eggs, except in a case where one lived for more than 5 weeks and produced eight batches.

Roy (D. N.). **On the Breeding Habits of** *A. stephensi* **as observed in the Laboratory.**—*Ind. J. Med. Res.*, xix, no. 2, pp. 635–639. Calcutta, October 1931.

The following method was found to be the most satisfactory for rearing *Anopheles stephensi*, List., in the laboratory. A caged rabbit was placed for the night under a mosquito curtain with mosquitos of both sexes. Long tin canisters were placed on the floor as shelter for the adults. The pots in which the eggs were laid were removed when the larvae hatched, and the larvae were picked up by means of a pipette and placed in a small earthen pot or enamel pan containing an abundance of ordinary grass, with the ends of the blades projecting above the surface of the water. The grass is stated to keep the water cool and aid in oxygenation, to divide the water into compartments and prevent the larvae from preying on one another, to provide some food for the larvae, and to prevent the formation of scum, which quickly asphyxiates them. The food found to ensure the most rapid growth of the larvae was finely powdered manure lightly sprinkled on the surface and dead mosquitos filled with blood. Ordinary dust may also be used. Even when food is apparently scarce, larvae frequently thrive when left in the shade exposed to the rains. Moreover, they have been found to develop more rapidly under these conditions than when sheltered from the rain with abundant food. Drizzle stimulates growth to a greater extent than rain falling in larger drops. Water should be changed very frequently, about every 3–4 days, even when no scum forms on the surface. Larval mortality has been found to vary in the laboratory from 97 to 60 per cent., when conditions are most favourable. Mortality is highest in the first stage and lowest in the last. When similar food material is available, the larvae are found to grow more rapidly and show a lower mortality in pots in which the water is only a few inches deep than in those where the water is 1½–2 ft. deep. Experiments indicate that when overcrowded, the larger larvae feed on the smaller ones, though dead individuals are never eaten. It has been found possible to reduce the mortality among the young larvae to a certain extent by leaving them for the first 3–4 days in the pots in which they hatch, sprinkling fine dust on the surface of the water twice a day. When subjected to a constant temperature of 24° C. [75·2° F.], larvae usually mature in 16–20 days, whereas at 12° C. [53·6° F.] the large ones only survive for 3–4 days and the small ones for 24 hours.

Kunhi Kannan (K.). **Report of the Work of the Entomological Section during the Year 1929–30.**—*Ann. Rep. Agric. Dept. Mysore 1929–30*, pp. 25–29. [Bangalore, 1931.]

Further tests against mosquito larvae with the powdered bark of *Mundulea suberosa* [*cf. R.A.E.*, A, xix, 164] indicated that it would be of value in shallow water and marshes, but could not be used where fish are preserved as it is an active fish poison. Its effect on cattle has not been tested.

Jacques (F.). **Possible contributing Causes of a small Outbreak of Malaria in a controlled Area.**—*Malayan Med. J.*, vi, no. 4, pp. 125–126. Singapore, December 1931.

The author briefly discusses small outbreaks of malaria in Malaya and their relation to breeding-places of *Anopheles maculatus*, Theo.

He concludes that in time of drought this mosquito may be found in unusual breeding-places, using any reasonably clean water that is small in extent, whether still or slowly moving.

STOKER (W. J.). *Anopheles montanus* (*Anopheles albotaeniatus* **var.** *montanus* **Stanton & Hacker, 1917**). [*In Dutch.*]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxi, no. 14, pp. 1206–1209, 4 figs., 7 refs. Batavia, 1931. Also in English in *Meded. Dienst Volksgezondh. Ned.-Ind.*, xx, pt. 2, pp. 129–132, 4 figs., 7 refs. Batavia, 1931.

Anopheles montanus, Stanton & Hacker, described as a variety of *A. albotaeniatus*, Theo. [*R.A.E.*, B, v, 54] and not hitherto recorded outside the Federated Malay States, was found in April 1931 in the interior of Borneo. A description is given of the larva, which is indistinguishable from that of *A. peditaeniatus*, Leic., given by Walch [xviii, 184]. It is possible that under the latter name Leicester associated the larva of *A. montanus* and the adult of *A. hyrcanus* (*sinensis*) [var. *nigerrimus*, Giles (*cf.* xviii, 43)]. Descriptions of the adults of both sexes of *A. montanus* are also given. In Borneo the larvae were found in clear water with dead leaves and twigs, little vegetation, and heavy shade. They usually occurred with those of *A. leucosphyrus*, Dön., and less often with *A. aitkeni*, James, *A. umbrosus*, Theo., and *A. novumbrosus*, Strickl.

SOESILO (R.) & VAN SLOOTEN (J.). **Verspreide aanteekeningen over Anophelinen in den Oost-Indischen Archipel.** [Miscellaneous Notes on Anopheline Mosquitos in the Netherlands Indies.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxi, no. 15, pp. 1254–1259, 7 figs., 8 refs. Batavia, 1931. Also in English in *Meded. Dienst Volksgezondh. Ned.-Ind.*, xx, pt. 2, pp. 124–128, 7 figs., 8 refs. Batavia, 1931.

A description is given of the male of *Anopheles* (*Nyssorhynchus*) *schüffneri*, Stant., from East Java. Figures are given of the male genitalia of *Bironella de rooki*, sp. n., *B. papuae* var. *brugi*, n., and what is thought to be *B. soesiloi*, Strickl. & Chowd. [*cf. R.A.E.*, B, xix, 243], as well as notes on an unidentified larva allied to *B. travestitus*, Brug, and *B. gracilis*, Theo., all of which were obtained from New Guinea.

MANALANG (C.). **Malaria Transmission in the Philippines. V. On the Maturation of the Ova of** *Anopheles funestus* **Giles. VI. The dark-night Factor.**—*Philipp. J. Sci.*, xlvi, no. 3, pp. 363–375, 1 graph. Manila, November 1931.

The first paper gives data on *Anopheles minimus*, Theo. (*funestus*, auct.) collected in two localities in the Philippines from September 1927 to August 1929 showing that higher rates of malaria infection in the mosquito occur during the period when the largest percentage of females contain mature ova, a finding opposed to that of James in England [*R.A.E.*, B, xviii, 32]. This indicates not only that this species survives oviposition, but that the period of maximum maturation of eggs is the period of malaria transmission. The rate of infection has been shown to rise with an increase in temperature, humidity and rainfall [xix, 247], meteorological factors that undoubtedly accelerate the development of eggs and induce the mosquito to seek a blood meal for their maturation. Thus the female becomes infected, and, having deposited the first batch of eggs, seeks a second blood meal for the maturation of a second batch of eggs and so transmits the infection.

The second paper is based on data on the infectivity and density of *A. minimus* in one of the above localities, collected from December 1927 to December 1928. It was found that of the infected mosquitos caught from May to December 1928 (the period when dark and bright nights were recorded), 87 per cent. were caught on dark nights and only 13 per cent. on bright nights. Including the dry months (December 1927–April 1928) when dark and bright nights were calculated from the calendar as those for the week preceding and following the new moon and the full moon respectively, the percentage of infected mosquitos caught on dark nights over the entire period was 80 and on bright nights 20, thus showing that the chances of malaria transmission are four times as great during dark nights. The average nightly catch of mosquitos for the thirteen months was 23 in the new moon periods and 20 in the full moon periods.

GORDON (R. M.). **The Effect of Street Drainage on the Number of Anophelines occurring in Freetown.**—*Rep. Med. Sanit. Dept. Sierra Leone 1930*, p. 90. Freetown, 1931.

An investigation on the effect of street drainage on the prevalence of mosquitos in an area of Freetown where malaria has been reported to be hyperendemic was begun in June 1930. The number of mosquitos caught in houses during the year was low. During the rainy season of 1930 the Anopheline rate per room was 0·32, whereas in an uncanalised suburb at a similar period of the year it was six times as great. On the other hand the infection rate was high ; it appears probable that at least 7 per cent. of the Anophelines occurring in houses are infected with malaria, and not less than 2 per cent. with filarial larvae.

Although in the suburbs *Anopheles gambiae*, Giles, *A. funestus*, Giles, and *A. nili*, Theo., occur in houses, only *A. gambiae* was encountered in the area of Freetown that is being canalised.

ANDERSON (D.). **Notes on Mosquito-borne Diseases in Southern Nigeria, II. Mosquito Intensity and Infectivity in Relation to Malaria.**—*J. Trop. Med. Hyg.*, xxxiv, no. 23, pp. 389–390. London, 1st December 1931.

The density of *Anopheles gambiae*, Giles (*costalis*, Theo.) and its malaria infection rate were studied in the town of Abeokuta in south-western Nigeria [*cf. R.A.E.*, B, xix, 231] during the rainy season, which lasts from the latter half of March to late October or early November, with a break in August.

The following is taken from the author's summary : The intensity is highest in May-June and then falls progressively. The infection rate rises during this period, but does not increase proportionately with the decrease in mosquito intensity. The most dangerous time of the year from the malarial point of view is, therefore, the first part of the rainy season, a conclusion that is supported by hospital statistics for malaria admissions, which show a peak early in the wet season followed by a progressive decrease in numbers, although heavy rainfall continues for some months.

SHANNON (R. C.). **List of Species of Argentine Culicidae.**—*6. Reun. Soc. argent. Pat. reg. Norte, 1930*, pp. 494–500. Buenos Aires, 1931.

This list combines the records as given by Dyar [*R.A.E.*, B, xvi, 167] and by Shannon & Del Ponte [xvii, 14]. It includes some new synonymy and a few additional records.

NIÑO (F. L.). **Nueva contribución al estudio de la distribución geográfica del** *Triatoma infestans* **(Klug) en la República Argentina y de sus índices de infección por el** *Schizotrypanum cruzi*. [A new Contribution to the Study of the geographical Distribution of *T. infestans* in Argentina and of its Infection by *Trypanosoma cruzi*.]—*6. Reun. Soc. argent. Pat. reg. Norte, 1930*, pp. 521–524, 1 map. Buenos Aires, 1931.

Records additional to those already published [*R.A.E.*, B, xiv, 224; xviii, 185] are given of the occurrence of the Reduviid, *Triatoma infestans*, Klug, in various parts of Argentina and of its natural infection with *Trypanosoma* (*Schizotrypanum*) *cruzi*.

Mosquito Investigations and Control.—*Rep. New Jersey Agric. Expt. Sta. 1929–30*, pp. 121–136. New Brunswick, N.J., 1931.

An account is given of the anti-mosquito work carried out in New Jersey during 1929–30, including references to some of the investigations already noticed [*R.A.E.*, B, xix, 102, 127–131]. Papers by F. W. Miller deal with biological investigations, rainfall in relation to mosquito production, the outstanding activities of the year in the various counties, and the species occurring during the period under report.

CARDAMATIS (J. P.). **A propos des nouvelles théories sur le paludisme.**—*Riv. Malariol.*, x, no. 3, pp. 311–320. Rome, 1931. (With Summaries in Italian p. 415, French p. 418, English p. 420, German p. 422.)

This is a survey, based on the literature, of the various factors affecting the severity of malaria, including such points as a possible immunity of the inhabitants, differences in the mosquito population, and climatic conditions such as high temperature.

DE MIGLIO (U.). **Campagna antimalarica dell' anno 1930 nell' Agro Crotoniate.** [The antimalarial Campaign in 1930 in the Agro Crotoniate District.]—*Riv. Malariol.*, x, no. 3, pp. 348–354. Rome, 1931. (With Summaries in Italian p. 416, French p. 419, English p. 421, German p. 423.)

From January to November 1930, all the adult mosquitos captured in this area in south Italy were *Anopheles maculipennis*, Mg., though *A. superpictus*, Grassi, had been observed there in November 1929.

HASE (A.). **Siphunculata ; Anoplura ; Aptera. Läuse.**—*Biol. Tiere Deutschlands*, Teil 30, pp. 1–58, 59 figs., 15 refs. Berlin, Borntraeger, 1931. Subscription Price *M*.12 ; single copies *M*.24.

In this further section of this work [*R.A.E.*, A, xi, 199], a general account is given of the morphology and biology of lice.

ROUBAUD (E.). **Les recherches d'entomologie médicale aux Colonies.**—*Actes & C.R. Assoc. Colon.-Sci.*, vii, no. 77, pp. 232–242, in *Rev. Bot. appl.*, xi, no. 123. Paris, November 1931.

The problem of parasitic diseases of man and animals in the French Colonies is one of the most fundamental in colonisation, and the importance of applied entomology in dealing with such diseases, which are for the most part insect-borne, cannot be over-estimated. Examples are quoted of successes that have been gained in combating malaria, yellow fever and various forms of trypanosomiasis. There is, however, still much to be done in the French Colonies, especially with regard to ticks and tick-borne diseases, of which very little study has as yet been made. In view of the importance of hygiene, public health, stock-raising, food and agricultural production, one medical entomologist at least should be appointed by the administrator of each colony.

AUBERTIN (D.). **Notes on the Oriental Species of the Genus** *Chrysomyia*.—*Ann. Mag. Nat. Hist.*, (10) ix, no. 49, pp. 26–30, 3 figs. London, January 1932.

Microcalliphora, Towns., is considered a subgenus of *Chrysomyia* ; it includes *C. varipes*, Macq. (the type) and *C. flavifrons*, Aldr., both occurring in Australia, and *C. nigripes*, sp. n., here described from Ceylon.

The author corrects Patton's synonymy of *C. combrea*, Wlk. [*R.A.E.*, B, x, 154]. An examination of the genitalia shows *C. defixa*, Wlk., to be a distinct species, *C. nigriceps*, Patt., a synonym of *C. pinguis*, Wlk., and *C. combrea* a synonym of *C. megacephala*, F. *C. defixa* and *C. pinguis* are re-described, and a key is given to the Oriental species of *Chrysomyia*.

ROBERTS (F. H. S.). **Some Notes on the Biology of Queensland Sheep Blowflies.**—*Queensland Agric. J.*, xxxvi, pt. 4, pp. 404–409, 1 pl. Brisbane, 1st October 1931.

Nine species of blow-flies are recorded as attacking sheep in Australia, but only eight have been found in Queensland, for *Calliphora australis*, Boisd., is confined to Western Australia. There is only one record of *Sarcophaga froggatti*, Tayl., attacking sheep, and the Anthomyiid, *Peronia rostrata*, R.-D., appears only to have been bred from sheep already infested by other maggots. The remaining six species concerned are the Calliphorids, *Lucilia sericata*, Mg., *Calliphora augur*, F., *C. stygia*, F., *Chrysomyia rufifacies*, Macq., *C. micropogon*, Big., and *C. (Microcalliphora) varipes*, Macq.

The life-histories of the several species are very similar, and details are therefore given for that of *L. sericata* only, the other species being mentioned by way of comparison. A single female may lay more than 1,000 eggs, as many as 250 being laid at one time. In summer the eggs may hatch within 16 hours, but in mid-winter they may require 3 days or even more in a very cold climate. The larvae are fully fed in 4 days in summer, but may take more than 7 days in winter. Pupation occurs in the ground, and the prepupal period lasts about 2 days in summer and 22 days or more in winter. The pupal stage may occupy only 6 days in summer, but 17 or more in winter. Thus the total life-cycle may be completed in 13 days in summer and 49 or more in winter.

For *Chrysomyia rufifacies* and *C. varipes* the respective periods are 9 and 36 days, and for *Calliphora augur* 17 and 33 days. The life-cycle periods of the remaining species are not yet completely known, but in summer *Sarcophaga froggatti* is said to emerge in 22 days, and *Chrysomyia micropogon* in 12 days. In spring *Calliphora stygia* takes about 30 days, and *Peronia rostrata* 26–43 days. The range of flight of the adults and their longevity are discussed, together with theories as to the cause of sheep being struck by flies.

Smit (B.). **A Study of the Sheep Blow-flies of South Africa.**—*17th Rep. Dir. Vet. Serv. Anim. Indust. S. Afr.*, Pt. i, pp. 299–421, 9 pls., 4 figs., 5 diag., 1 map, 177 refs. Pretoria, August 1931.

This paper gives a detailed account of investigations on sheep blow-flies in South Africa begun in 1922. Most of the information has already been noticed from reports published in the interim [*R.A.E.*, B, xv, 119; xvii, 153; xviii, 11, 157]. The dressing now recommended for the treatment of infested sheep consists of 45 parts cottonseed oil, 40 parts petrol, 10 parts pine tar oil, and 5 parts carbolic acid (all measured by volume). This mixture has been thoroughly tested for two years and has given excellent results. Owing to the large proportion of petrol, it is cheap and effective in killing the maggots. It also spreads well through the wool. The cottonseed oil soothes the skin and helps to allay inflammation, the pine tar oil acts as a repellent and the carbolic acid destroys harmful bacteria. It is concluded from numerous experiments that burying is an unsatisfactory method for disposal of carcases; flies may emerge from a carcass containing full-grown maggots, buried at a depth of six feet.

Alexander (R. A.). **Heartwater.—The present State of our Knowledge of the Disease.**—*17th Rep. Dir. Vet. Serv. Anim. Indust. S. Afr.*, Pt. i, pp. 89–150, 4 pp. refs. Pretoria, August 1931.

The author reviews the knowledge regarding heartwater of sheep, goats and cattle in Africa from the discovery of the disease up to the present day. The account of original research is confined chiefly to a study of the causal agent in the vertebrate and invertebrate hosts that produced almost entirely negative results. In South Africa at least, the important vector is *Amblyomma hebraeum*, Koch. A brief description of the biology of this tick is given, based mainly on the confirmed findings of Lounsbury published in 1901.

Steyn (D. G.). **The Toxicity of the Pupae of the Moth** *Nudaurelia cytherea*.—*17th Rep. Dir. Vet. Serv. Anim. Indust. S. Afr.*, Pt. i, pp. 423–429, 1 fig. Pretoria, August 1931.

In a locality in South Africa where the Saturniid, *Nudaurelia cytherea*, F., was causing serious damage to pine trees, pigs were let loose in the plantations to destroy the larvae and pupae. Many of the animals died, and experiments carried out with the pupae of this moth showed them to be toxic to rabbits and pigs on oral administration and to guineapigs when inoculated subcutaneously in the form of ethereal, chloroform or aqueous extracts. The toxin is a severe gastro-intestinal irritant.

VEITCH (R.). **Report of the Chief Entomologist.**—*Ann. Rep. Dept. Agric. Queensland 1930–31*, pp. 43–46. Brisbane, 1931.

In Queensland, *Lyperosia exigua*, de Meij. (buffalo fly) spread considerably further to the east and south during the summer of 1930–31 [*cf. R.A.E.*, B, xix, 89].

SHEW (W. D.). **Bots in Horses.**—*J. Dept. Agric. Vict.*, xxix, pt. 10, pp. 492–493, 1 fig. Melbourne, October 1931.

Notes are given on the bionomics and control of horse bot-flies, of which three species occur in Australia, namely, *Gastrophilus intestinalis*, DeG. (common bot), *G. nasalis*, L. (throat bot) and *G. haemorrhoidalis*, L. (red-tailed bot or nose fly).

TRAVASSOS (L.). **Algumas observações sobre a** *Dermatobia hominis* (**L.J., 1781**) (**Diptera: Oestridae**). [Some Observations on *D. hominis*, Say.]—*Bol. biol.*, fasc. 18, pp. 35–38, 4 figs. Rio de Janeiro, 10th October 1931.

Observations in Brazil show that the female of *Dermatobia hominis*, Say, if its eggs are ready for immediate deposition, actively seeks insects for their transport, but otherwise settles on cattle and awaits a suitable carrier. White cattle are most attractive to this fly. The male genitalia and the spermathecae of the female are described and figured.

ENDERLEIN (G.). **Zur Beurteilung und Bekämpfung der Kriebelmücken-Schäden des Leinegebietes.** [On the Estimation and Control of the Injury by Simuliids in the Leine Region.]—*Arch. wiss. prakt. Tierhlk.*, lxiii, no. 6, pp. 475–528, 11 figs. Berlin, 1931.

Losses among cattle due to Simuliids occur over an extensive region including parts of Bulgaria, Rumania, and Jugoslavia, and in the valley of the Leine in Hanover [*R.A.E.*, B, xvii, 71, etc.].

This paper includes an annotated list of the SIMULIIDAE in the Leine region with keys ; accounts of the effect on cattle of the toxin secreted by the salivary glands of the females ; a survey of the conditions that favour injury, such as the introduction from uninfested regions of cattle that have no acquired immunity, and a decrease in the wild duck, fish, Trichoptera and similar predators of Simuliids in the waters concerned ; notes on climatic conditions and natural enemies ; and a survey of the various possible preventive and curative measures.

GANSSER (A.). **Beitrag zur Kenntnis der Dasselfliege.** [A Contribution to the Knowledge of the Warble Fly.]—*Schweiz. Arch. Tierhlk.*, lxiii, no. 3, pp. 128–132. Zurich, March 1931.

Though actual oviposition by a captive female of *Hypoderma bovis*, DeG., was not observed, examination of the various objects placed in its cage, including dry moss at the bottom and a piece of calf skin covered with hair, disclosed the eggs on the bottom of the cage beneath the moss, so that a sheltered position seems to be chosen rather than any given object. It would therefore appear that, failing animal hosts, eggs may sometimes be laid on plants, thus involving the possibility of their reaching the mouth of animals in fodder, and of infestation of man, which is less rare in Switzerland than usually supposed, originating from eggs or larvae on parts of plants.

MORRIS (H. M.). **Annual Report of the Entomologist for 1930.**—*Ann. Rep. Dept. Agric. Cyprus 1930*, p. 52. Nicosia, 1931.

The species of *Hypoderma* recorded from Cyprus on goats as *H. crossi*, Patton [*R.A.E.*, B, xix, 35] is *H. aeratum*, Aust. [xix, 262].

[TZUIGANKOV (S.).] **Цыганков (С.). Note on the Accumulation of Chloropidae in Dwellings.** [*In Russian.*]—*Plant Protection*, vii (1930), no. 1–3, pp. 163–164, 5 refs. Leningrad, 1931.

A brief account is given of the occurrence of large swarms of *Chlorops notata*, Mg., in various parts of European Russia during 1920–1928. The flies usually appeared in the second half of August and September, and invaded attics, verandahs, and the upper rooms of houses ; in one instance they congregated in the spring, and in another as late as 7th November. This fly hibernates in the adult stage.

PAPERS NOTICED BY TITLE ONLY.

MUKERJI (S.). **On the Morphology of the Terminal Segments of Psychodidae Larvae and their Taxonomic Importance. (With a short comparative Account of the microscopic Structure of the Pseudo-leg of** *Phlebotomus argentipes*, **Ann. and Brun.)**—*Ind. J. Med. Res.*, xix, no. 2, pp. 433–446, 3 pls., 2 figs., 14 refs. Calcutta, October 1931.

BARRAUD (P. J.). **Descriptions of eight new Species of Indian Culicine Mosquitoes.**—*Ind. J. Med. Res.*, xix, no. 2, pp. 609–616, 1 pl., 1 ref. Calcutta, October 1931.

MUKERJI (S.). **The Process of Copulation in** *Phlebotomus argentipes* **Ann. & Brun.**—*Parasitology*, xxiii, no. 4, pp. 443–444, 1 fig., 1 ref. Cambridge, November 1931.

SWAN (D. C.). **On a new Species of** *Ixodes* (*Ix. hydromyidis*) **from Western Australia.**—*Parasitology*, xxiii, no. 4, pp. 485–487, 1 fig., 4 refs. Cambridge, November 1931.

HINMAN (E. H.). *Pediculus* (*Parapediculus*) *atelophilus* **Ewing 1926** [descriptions of the egg, first stage larva and female] **from the Red Spider Monkey,** *Ateles geoffroyi*.—*Parasitology*, xxiii, no. 4, pp. 488–491, 2 figs., 3 refs. Cambridge, November 1931.

ARAKAWA (Y.). **On the Blood-sucking and Digestion of the Clothes Louse** [*Pediculus humanus*, L.]. [*In Japanese.*]—*Insect Wld.*, xxxv, pp. 265–269, 302–306. Gifu, 1931.

BAGNALL (R. S.). **On Mallophaga (Biting-lice) affecting the Mammals of Northumberland and Durham.**— *Vasculum*, xviii, no. 1, pp. 14–18. Newcastle-on-Tyne, February 1932.

KRIJGSMAN (B. J.) & PONTO (S. A. S.). **Die Verbreitung der Zecken in Niederländisch-Ostindien.** [The Distribution of Ticks in the Netherlands East Indies.]—*Z. Parasitenk.*, iv, no. 1, pp. 140–146, 5 maps, 23 refs. Berlin, 4th December 1931.

MAZZA (S.) & DE CORES (L. C.). **Acerca de ulceraciones genitales y otras lesiones producidas por garrapatas en el hombre.** [On a Case of Ulceration of the Genitalia and other Lesions caused by a Tick, *Amblyomma cayennense*, F., in Man in Argentina.]—*6. Reun. Soc. argent. Pat. reg. Norte, 1930*, pp. 482–484, 1 fig. Buenos Aires, 1931.

NITZULESCU (V.). **Considérations sur le rôle des mandibules dans la trompe des insectes piqueurs.**—*6. Reun. Soc. argent. Pat. reg. Norte, 1930*, pp. 501–513, 14 figs., 8 refs. Buenos Aires, 1931.

MAZZA (S.) & ARIAS ARANDA (C.). **Nuevo caso de aracnoidismo por** ***Latrodectus.*** [A new Case of Arachnoidism in Argentina due to the Bite of the Spider, *Latrodectus curacaviensis*, Müller.]—*6. Reun. Soc. argent. Pat. reg. Norte, 1930*, pp. 525–527, 2 figs. Buenos Aires, 1931.

CONNAL (S. L. M. S.). **The Larva and Pupa of** *Uranotaenia ornata*, **Theo.**—*Bull. Ent. Res.*, xxii, pt. 4, pp. 459–460, 2 figs. London, December 1931.

BEQUAERT (J.). **Tabanidae of the Peninsula of Yucatan, Mexico, with Descriptions of new Species.**—*J. N.Y. Ent. Soc.*, xxxix, no. 4, pp. 533–553, 3 figs. New York, December 1931.

KRIJGSMAN (B. J.). **Reizphysiologische Untersuchungen an Blutsaugenden Arthropoden im Zusammenhang mit ihrer Nahrungswahl. I. Teil.** *Stomoxys calcitrans.* [Investigations on the physiological Stimuli of blood-sucking Arthropods in Connection with their Choice of Food. I. *S. calcitrans*, L.]—*Z. vergl. Physiol.*, xi, pp. 702–729, 2 figs. Berlin, 1930. [*Cf. R.A.E.*, B, xix, 22.]

KRIJGSMAN (B. J.) & WINDRED (G. L.). **Reizphysiologische Untersuchungen an Blutsaugenden Arthropoden im Zusammenhang mit ihrer Nahrungswahl. II. Teil.** *Lyperosia exigua.* [Investigations on the physiological Stimuli of blood-sucking Arthropods in Connection with their Choice of Food. II. *L. exigua*, de Meij.]—*Z. vergl. Physiol.*, xiii, pp. 60–73, 2 figs. Berlin, 1930. [*Cf. R.A.E.*, B, xix, 22.]

GIL COLLADO [J.]. **Note sur le "Jen-jen"** [*Culicoides hostilissimus*, Pittaluga] **de Fernando Poo.**—*Bull. Soc. Path. exot.*, xxiv, no. 8, pp. 672–677, 2 figs., 6 refs. Paris, 1931. [*Cf. R.A.E.*, B, xix, 194.]

SCOTT (H.). **Some Nycteribiidae from the Australian Region. Part I: Species from the New Hebrides.**—*Stylops*, i, pt. 1, pp. 16–24, 6 figs. London, 15th January 1932.

HOBBY (B. M.). **A List of the Prey of Dung-flies (Diptera, Cordyluridae).**—*Trans. Ent. Soc. S. England*, vii, pt. 1, pp. 35–39, 12 refs. Southampton, 12th December 1931.

JORDAN (K.). **Further Records and Descriptions of Fleas from Ecuador.**—*Novit. Zool.*, xxxvii, no. 1, pp. 135–143, 12 figs. Tring, 21st December 1931.

JORDAN (K.). **Three new Old World Fleas.**—*Novit. Zool.*, xxxvii, no. 1, pp. 144–147, 6 figs. Tring, 21st December 1931.

PINTO (C.). **Caracteristicas morfologicas da larva de** *Ctenocephalides felis* **(Bouché, 1835). (Siphonaptera. Pulicidae.)** [Morphological Characters of the Larva of *C. felis*.]—*Bol. biol.*, fasc. 18, pp. 28–34, 5 figs., 8 refs. Rio de Janeiro, 10th October 1931.

SKOBELTZYNE (V.). **Influence du système nerveux sur l'immunité chez les chenilles de** *Galleria mellonella*.—*Ann. Inst. Pasteur*, xlvii, no. 6, pp. 660–666, 3 graphs. Paris, December 1931.

TWINN (C. R.). **Note on the Biting Midge,** *Culicoides obsoletus* **Mgn., in eastern Canada.**—*Canad. Ent.*, lxiii, no. 11, p. 248. Orillia, Ont., November 1931.

Culicoides obsoletus, Mg., of which *C. sanguisugus*, Coq., is stated by W. A. Hoffman to be a synonym, is recorded as causing annoyance to man in several localities in Quebec and Ontario.

THEODOR (O.). **On African Sandflies (Dipt.).**—*Bull. Ent. Res.*, xxii, pt. 4, pp. 469–478, 2 pls., 6 figs., 14 refs. London, December 1931.

Notes are given on a collection of sandflies sent for identification, which include *Phlebotomus squamipleuris* var. *indicus*, n., from India, *P. nairobiensis*, sp. n., from Kenya and Uganda, and *P. decipiens*, sp. n. (which is the species from the Belgian Congo wrongly identified by Adler, Theodor and Parrot as *P. simillimus*, Newst. [*R.A.E.*, B, xviii, 5]). *P. brodeni*, Parrot [xviii, 235] is a synonym of *P. simillimus*, *P. signatipennis*, Newst., of *P. minutus*, Rond., and *P. symesi*, Sint. [xviii, 265] of *P. schwetzi*, Adl., Thdr. & Parr. A key is given for identification of both sexes of African sandflies, which include 20 fully described and 4 doubtful species.

TOBBACK (L.). **Piégeage des Tsé-tsés.**—*Bull. agric. Congo belge*, xxii, no. 2, pp. 243–251, 4 figs., 2 refs. Brussels, June 1931.

A short account is given of the bionomics of *Glossina* in the Belgian Congo, with a very brief review of the indirect methods that have been practised in other countries to reduce the numbers of the flies and a description of the direct method of attack by means of the trap suggested by Harris [*R.A.E.*, B, xix, 13, 78].

SCOTT (J. D.). **A practical Method of marking Insects in quantitative Samples taken at regular Intervals.**—*S. Afr. J. Sci.*, xxviii, pp. 372–375, 16 refs. Johannesburg, November 1931.

The method of marking individuals of *Glossina morsitans*, Westw., used in investigations in Tanganyika Territory is outlined. This enables the area, date and time of marking of individuals caught regularly twice a day at different stations to be determined on recapture. A practical method of handling the paints in the field is described.

FRANCHINI (G.). **Encore au sujet des spirochètes des euphorbes.**—*Bull. Soc. Path. exot.*, xxiv, no. 9, pp. 809–811. **Etude sur un flagellé spécial du latex d'un figuier de l'Erythrée** (*Ficus hochstetteri* **(Mg.) A. Rich).**—*T.c.*, pp. 843–848, 2 figs. Paris, 1931.

In the first paper *Spirochaeta roubaudi*, sp. n., is described from the latex of *Euphorbia palustris* in Italy. No insects were found on the plant. During the year, however, many species of flies were caught on various kinds of *Euphorbia* at Bologna, and numerous spirochaetes as well as flagellates were found in their intestines and dejecta [*cf. R.A.E.*, B, xi, 56].

In the second paper, *Herpetomonas* (*Leptomonas*) *ganorae*, sp. n., is described from the latex of *Ficus hochstetteri* in Eritrea. In this flagellate multiplication usually takes place by means of transverse division [*cf.* xii, 35].

LESTOQUARD (F.) & EKREM (I.). **Les piroplasmes du mouton en Turquie.**—*Bull. Soc. Path. exot.*, xxiv, no. 9, pp. 822–826. Paris, 1931.

In the course of an investigation on piroplasmosis of sheep in Turkey, where the most important form is that caused by *Babesiella ovis*, it was found that outbreaks may often be checked by removing the sheep to higher altitudes. That this may not always be the case is shown by the fact that *Rhipicephalus bursa*, C. & F., and *R. sanguineus*, Latr., were found on sheep at approximately 6,500 ft. The degree of engorgement clearly indicated that these ticks had attached themselves during the month that the sheep had been present on the higher pastures. It is therefore concluded that, in spite of the severity of the winters at such heights, the ticks can become acclimatised and consequently may transmit *B. ovis*.

NIESCHULZ (O.) & WAWO-ROENTOE (F. K.). **Einige Versuche mit** [Some Experiments with] *Piroplasma canis* **und** *Rhipicephalus sanguineus*.—*Z. InfektKr.*, xl, no. 1, p. 60, reprint 4 pp. Berlin, 1931.

Numbers of *Rhipicephalus sanguineus*, Latr., that were descendants of ticks obtained from Java [*R.A.E.*, B, xviii, 163] were fed on dogs infected with a strain of *Piroplasma canis* that had previously been maintained for a long period by direct passages, and were then placed on others or injected into them subcutaneously. Though about 1,000 larvae, 700–800 nymphs, and over 400 adults were used, only negative results were obtained.

[ZASUKHIN (D. N.).] **Засухин (Д. Н.). Materials for the Study of the Parasites in the Blood of the Rodents in the South-east of the R.U.F.S.R. Communication ii. Blood-parasites of the Steppe Ground Squirrel.** [*In Russian.*]—*Rev. Microbiol.*, ix, no. 4, pp. 555–571, 3 figs., 1 pl., 81 refs. Saratov, 1930. (With a Summary in German.) [Recd. December 1931.]

In the course of research on piroplasmosis of *Citellus pygmaeus*, carried out in the spring and summer of 1929 and 1930 in a western district of the former Ural'sk Government, *Rhipicephalus schulzei*, Olenev, was found to be the vector of the causal agent, *Piroplasma kolzovi*, sp. n. This was by far the most prevalent tick found on the ground squirrels, and epizootics invariably occurred in localities where they were heavily infested with its larvae and nymphs. Larvae were very numerous on young ground squirrels in May, older animals being but slightly infested. The nymphs were abundant at the end of May and beginning of June, and the adults occurred from 20th June onwards. Oviposition was observed on 11th July. There is evidence that hibernation occurs in the nests of *Citellus* in both the adult and egg stages.

Sergent (Ed.), Donatien (A.), Parrot (L.) & Lestoquard (F.). **Recherches sur le mode de propagation et sur le réservoir de virus de la theilériose nordafricaine** (*Theileria dispar*).—*Ann. Inst. Pasteur*, xlvii, no. 6, pp. 579–600, 10 figs. Paris, December 1931.

An account is given of the authors' experiments in Algeria on the transmission by ticks of the form of bovine piroplasmosis caused by *Theileria dispar* [*R.A.E.*, B, xvi, 267; xix, 91], showing that *Hyalomma mauritanicum*, Senevet, is the vector. Notes are also given on the bionomics of this tick [*cf.* xix, 91]. The nymphs hibernate, generally in groups, in cracks and crevices in walls and between stones, usually at a considerable height (sometimes 6 ft. or more) above the ground level, and unlike those of *Rhipicephalus bursa*, C. & F., are never found in fields without trees or boulders. A favourite place for hibernation is in the walls of farmyards. They resume activity in the first warm days in June, those in sunny walls being the first to emerge. A few days after becoming adult, the ticks crawl about seeking a suitable host, working during the night in the direction of cattle sheds or stables; they have been known to travel more than thirty yards in a week in this manner. Adults are numerous on cattle throughout July and August, and pairing occurs as soon as the females have attached themselves. Those that do not become engorged until September oviposit, but the eggs do not hatch; those that engorge in October do not oviposit at all. By January, practically all females that have not found a host are dead. Unfertilised females take longer to engorge, and their eggs do not hatch. Males remain longer on the animal than females and may change their host. Unfed larvae may live for 10 months, and unfed adult females may survive for several months, whereas engorged ones oviposit and die. Cattle that survive an initial attack by *T. dispar* and harbour a latent infection may remain infective to ticks for as long as 15 months.

Lahille (F.) & Joan (T.). **La garrapata de las gallinas.** [The Fowl Tick.]—*Bol. Minist. Agric. Nacion*, xxx, no. 2, pp. 89–94, 1 fig., 1 pl. Buenos Aires, 1931.

An account of the bionomics and control of *Argas persicus*, Oken, is given in view of the fact that it is now widely distributed on fowls in Argentina, where it was first recorded in 1914.

Delanoë (P.). **Au sujet des échecs de transmission du spirochète marocain par des ornithodores adultes** (*O. erraticus* **L.**), **non infectants d'emblée.**—*Arch. Inst. Pasteur Tunis*, xx, no. 3, pp. 283–285, 3 refs. Tunis, 1931.

The author gives two examples in which adults of *Ornithodorus erraticus*, Lucas, caught in rodent burrows in Morocco and found to be uninfective by biting failed to infect guineapigs with *Spirochaeta hispanica* var. *marocana* after feeding on an infected host. Moreover, in the first case the bites of primary larvae resulting from these ticks also failed to infect, and in the second case a suspension of the engorged adult ticks injected into a healthy guineapig failed to produce an infection. An explanation is therefore necessary to show why it is possible to obtain in nature ticks infective by biting, when it is difficult if not impossible to transmit infection by the bites of ticks infected in the laboratory, either in the adult or nymphal stage.

DELANOË (P.). **Contribution à l'étude du pouvoir pathogène du spirochète marocain,** *Sp. hispanicum* **var.** *marocanum* **Ch. Nicolle et Ch. Anderson 1928.**—*Arch. Inst. Pasteur Tunis*, xx, no. 3, pp. 274–282. **Le réservoir de virus du spirochète marocain** *Sp. hispanicum* **S. de Buen, var.** *marocanum* **Ch. Nicholle et Ch. Anderson 1928.**—*T.c.*, pp. 286–314, 9 refs. Tunis, 1931.

In the first paper details are given of experiments demonstrating the susceptibility of foxes, weasels, and young rabbits and kittens inoculated with *Spirochaeta hispanica* var. *marocana.* In one fox, infection was obtained by the bites of adults and nymphs of *Ornithodorus* [*erraticus*, Lucas] from a porcupine burrow. No spirochaetes were found in the fox, but guineapigs were infected when inoculated with its blood.

In the second paper a detailed account is given of investigations on possible reservoirs of the spirochaete. A porcupine, gerbilles (*Meriones*), foxes, jackals and hedgehogs from Morocco were found to be naturally infected, a fact showing the lack of host specificity in the infecting tick. The reservoir may not be the same in different parts of the country; rabbits and wild cats may perhaps be concerned in areas where they are numerous. The preservation of the spirochaete appears to be so well assured in nature that eradication would be impossible. It is suggested that boots should be worn to avoid tick bites in the field, dwellings should be situated as far as possible from piggeries and the burrows of animals, and, if burrows occur near houses, the entrances should be blocked with cement. Arthropods found in earth from 5 gerbille burrows included a few fleas, 11 adults of *Hyalomma aegyptium*, L., and 2 adults and a nymph of *Ornithodorus*, none of which was infective.

ANDRÉ (M.). **Nouvelles observations sur la larve du** *Thrombidium holosericeum* **Linné.**—*Bull. Soc. ent. Fr.*, 1931, no. 18, pp. 259–261. Paris, 1931.

The author records the occurrence on various spiders in Switzerland of *Metathrombium poriceps*, Oud., which is the hexapod larval form of *Trombidium* (*Sericothrombium*) *holosericeum*, L. After transformation in the ground, octopod nymphs emerged in mid-October. Previous workers have observed that the adult deposits a mass of about a hundred eggs just below the ground surface in June and July and sometimes as early as the end of April. The hexapod larva hatching from the egg has a variety of hosts, including insects, birds, and man and other mammals. The mites reared on insects are considerably larger than those on vertebrates, and it is believed that the former are their normal hosts.

EWING (H. E.). **The relative Importance of Amphibians, Reptiles, Birds and Mammals as Hosts for Chiggers and other Ectoparasites.**—*Ann. Ent. Soc. Amer.*, xxiv, no. 4, pp. 746–750. Columbus, Ohio, December 1931.

A preliminary report is given of a census of the ectoparasites of various vertebrates taken during the spring, summer and autumn months in the Atlantic States from Maryland to Florida, the data being shown in a table and a chart. The species of hosts and parasites are not given. Mammals were the most heavily parasitised with

Arthropods, over 57 per cent. being infested. The outstanding finding, however, was the important part played by amphibians as hosts for chiggers [Trombiculid larvae], which were the only ectoparasites found on them, 23·8 per cent. being infested; of the reptiles, 16·4 per cent. harboured chiggers, of the birds 12·6 per cent., and of the mammals only 8·3 per cent.

RAYNER (J. A.). **Parasites of Wild Birds in Quebec.**—*Sci. Agric.*, xii, no. 5, pp. 307–309, 1 ref. Ottawa, Ont., January 1932.

Lists are given of the internal and external parasites of a certain number of wild birds taken in Quebec during June–August 1930. The widespread occurrence of *Liponyssus sylviarum*, C. & F., among these birds may possibly explain the sudden appearance at different times in more or less isolated localities of infestation of poultry by this mite [*cf. R.A.E.*, B, xix, 185].

PANNEWITZ (E.). **Ueber die Auswahl und Behandlung der Petroleumbasis bei Insektenvertilgungsmitteln.** [On the Selection and Preparation of the Petroleum Base in Insecticides.]—*Z. Desinfekt.*, xxiii, no. 11, pp. 465–476, 1 graph. Dresden, November 1931.

About 85–90 per cent. of the content of "fly-sprays" with a petroleum base consists of mineral oil, the selection and preparation of which is, therefore, important. Using several of the oil bases of effective proprietary fly-sprays, the author compared them with 7 other oils in order to obtain an indication as to which of the latter are likely to be satisfactory for the manufacture of such sprays. The examination of the oils as to boiling-point, residue, and temperature at which up to 50 volumes per cent. are given off was made by the Engler method, and these results and also the specific gravities are recorded in a series of tables. From the characteristics of the fly-sprays he considers that it is best to select an oil with a high natural content of toxic substances (*e.g.*, naphthenes in Russian oil) or one that, by cracking, has been enriched in olefinic, aromatic, or naphthene hydrocarbons. Mineral oil can be classed also according to the Riesenfeld "boiling point number," which for the fly-sprays tested averaged 43·9, and a typical base would be a fraction boiling between 160 and 297° C. with 0·5 per cent. distillation residue and 50 volumes per cent. given off at or below 221° C. and with a Riesenfeld number of 42·6, which is within 1·3 of the average named. The selection should be based on the following approximate Riesenfeld-Bandte figures: 11·4 per cent. olefines, 15·5 per cent. aromatic substances, 12·1 per cent. naphthenes, and 61 per cent. paraffins, and with 20·8 as the uncorrected toluol value. When the fluid is allowed to evaporate, it should leave the smallest possible residue.

LAAKE (E. W.), PARMAN (D. C.), BISHOPP (F. C.) & ROARK (R. C.). **The Chemotropic Responses of the House Fly, the Green-bottle Flies, and the Black Blowfly.**—*Tech. Bull. U.S. Dept. Agric.*, no. 270, 10 pp., 6 refs. Washington, D.C., November 1931.

During chemotropic tests with *Cochliomyia macellaria*, F., that have been carried out over a number of years in Texas [*R.A.E.*, B, xvii, 55; xvi, 135; etc.], observations were also made on the behaviour of *Musca domestica*, L., *Phormia regina*, Mg., and *Lucilia* spp. towards the materials used. The results of 192 tests are presented in tabular form and briefly discussed.

The following is largely taken from the authors' summary: The species of *Lucilia* do not appear to be as chemotropically sensitive as the other flies. It was noted that one species might be attracted by a material added to the bait whereas another is repelled by it. Pine-tar oils were strongly repellent to all the species of flies dealt with, and some of these oils are effective in destroying flies when sprayed as a mist over them in barns, etc. Clove oil and clove powder were also effective repellents against all species and, when mixed with vegetable oils, have been used with good results to protect fresh meat.

The bait was rendered more attractive by geraniol in the case of *P. regina*, by bromoform in the case of *Lucilia* spp., and by these two substances, ethyl mercaptan, chloroform, butyraldehyde, formaldehyde and arsenic solution in the case of *M. domestica*.

TILLYARD (R. J.). **The Buffalo-fly in Australia.**—*J. Council Sci. Ind. Res.*, iv, no. 4, pp. 234–243, 3 pls., 34 refs. Melbourne, November 1931.

A general account is given of the results so far obtained in investigations on *Lyperosia exigua*, de Meij. (buffalo-fly) [*cf. R.A.E.*, B, xix, 89], inaugurated in 1928, to obtain a comparative study of its bionomics in the contrasted regions of Australia and the Netherlands Indies, with a view to the establishment of biological control in the infested areas of the Commonwealth. Districts possessing a hot, humid climate are favourable to the fly, which breeds most abundantly in low-lying moist areas, particularly round the margins of waterholes, etc. Its introduction, spread and present distribution in the northern part of Western Australia and the Northern Territory, and the north-west of Queensland are discussed. Even though the present measures prove ineffective, the spread of the fly will probably be limited by rainfall, observations indicating that a yearly average of at least 20 ins. is the minimum it can tolerate. As, however, the coast-line of eastern Australia has an average rainfall of well above 20 ins., it is clear that once *L. exigua* reaches the coast of Queensland, it will spread steadily southwards. This area of probable infestation includes the best beef-producing and some of the best dairying country in Australia. Observations on the effect of temperature indicate that the fly is only likely to be destroyed by heavy frost. The problem of its biological control is discussed, including proposals for the introduction of parasites from the Netherlands Indies.

PHÉLOUKIS (T.) & KNITHAKIS (E.). **L'Habronémose cutanée en Grèce.**—*Bull. Acad. vét. Fr.*, iv, pp. 121–124. 1931. (Abstract in *Vet. Bull.*, ii, no. 1, p. 19. Weybridge, Surrey, Imp. Bur. Anim. Hlth., January 1932.)

Cutaneous habronemiasis of horses has not previously been recognised in Greece, the lesions having been confused with those due to other conditions. In the autumn of 1929 observations were made during an epizootic of granular dermatitis among horses in Athens, including a study of larvae from the summer sores and of those from *Musca domestica*, L., caught in the vicinity of stable manure, and 12 per cent. of the flies proved to be infected. The characters of the larvae showed them to be those of *Habronema megastoma*, and it is concluded that this species is the sole cause of cutaneous habronemiasis in Greece.

Walker (E. M.). **Cutaneous Myiasis in Canada.**—*Canad. Publ. Hlth. J.*, 1931, pp. 504–508, 2 figs., 4 refs. Toronto, Ont., October 1931.

Further cases of cutaneous myiasis in infants caused by *Wohlfahrtia vigil*, Wlk., are recorded from Canada [*R.A.E.*, B, ix, 1 ; x, 227]. In most cases 12–14 lesions were present, each with an external opening and each containing one or more larvae. In one instance at least 5 larvae were removed through a single opening, and in another about 40 lesions were present, from some of which 4–5 larvae were taken. In the earlier stages a slight macular rash may be present, and at this time the young larvae (2–3 mm. long) may be found wandering over the surface of the skin. Thus it appears that they may penetrate the skin at some distance from the point where they were deposited by the adult fly. In 4–12 days they attain a length of 20 mm., and a day or so later burrow into the earth and pupate. The flies emerge in about 18 days, but there is evidence that some pupae may remain in the ground for a year before producing adults [*cf.* xi, 152]. Most of the cases of myiasis were observed in June, but one occurred in September, and adult flies have been taken at various times during the summer months. Although somewhat rare, *W. vigil* may be found in almost any part of Canada, as it has been collected from the north-east of the United States to Alaska.

The morphology and habits of Sarcophagids in general are briefly discussed. It has been suggested that the parasitic habit of *W. vigil* is probably abnormal, because of the small size of the spines of the larval skin, which aid in locomotion and are usually better developed in parasitic Dipterous larvae than in those living in decomposing substances. On the other hand, the habit of penetrating healthy living skin is remarkable in a species that normally feeds on carrion. Moreover, the larvae have never been found in carrion except in connection with laboratory experiments, whereas they have been recorded as infesting rabbits [xi, 152 ; xv, 48] and foxes. In laboratory experiments (carried out by N. Ford), a gravid female was not attracted to pieces of liver (fresh and in various stages of decomposition), but showed a distinct preference for a guineapig or rabbit and deposited a number of larvae in the vicinity of the eye, which were vigorously scratched off by the animal. Five weeks later the same fly again became pregnant, but being too old and decrepit to maintain its hold on the fur of the guineapig, was forced to deposit its larvae on liver. In feeding experiments the flies were attracted to milk, sugar and flowers, but never to meat.

Children sleeping out-of-doors, especially during the summer, should be carefully screened. In cases of infestation the larvae should be removed immediately. They may generally be squeezed out through the external opening, no incision being necessary.

MacDougall (R. S.). **The Warble Fly Problem. Report on Experiments conducted in Scotland in 1931.**—75 pp., 11 figs. Edinburgh, Highl. Agric. Soc. Scotland, 1931.

Details are given of experimental work on the control of warble-flies (*Hypoderma*) in Scotland undertaken in 1931, when 22 counties and the Western Isles participated as opposed to 7 counties in 1930 [*R.A.E.*, B, xix, 89]. There is cumulative evidence that reliable derris preparations are both cheap and effective in killing the larvae and do not injure the health or hide of the treated animal. Moreover, a progressive reduction in the number of warbles during the season has been produced by three or four dressings. The majority of warbles are found in strips 7–8 ins. wide on either side of the backbone of the animal at a distance of 2–3 ins. from it, extending along the back from behind the shoulder to the hook bone. Squeezing the larvae from the warbles would be the most satisfactory measure of control, if it could be generally practised and thoroughly and systematically carried out. The first treatment should take place as soon as larvae are nearly mature (on an average not later that the middle of March), and further treatments should follow at intervals of about a month or rather less until the end of the season. A description is given of a wooden instrument with a cup-shaped lower end, which, when placed over the warble and pressed down, causes the expulsion of the larva. Larvae near the backbone or on the loin edge are easily removed with this tool, but those on the sides of the ribs or below the loin edge are more easily expressed with the fingers.

A derris and soft soap wash [xviii, 204] was again used with success. A powder in which derris is incorporated with soap, and to which water only has to be added before use, gave very satisfactory results, and although it is possibly not quite so effective as the soft soap wash, it has the advantage of being easier to prepare and handle and of being more economical. A liquid derris preparation that only required dilution with water, however, was not satisfactory. It was found that rain occurring after the application of dressings affected the percentage of larvae killed. Tests with hydrogen peroxide (at a strength of ten volumes, which contains about 3 per cent. H_2O_2) poured into the warbles of last-stage larvae of *Hypoderma bovis*, DeG., gave uneven results ; it acts by liberating free oxygen, and in some cases larvae were ejected with some force, whereas in others there was no response.

Certain animals were observed to be free from infestation in both 1930 and 1931, although others in the herd were affected in each year, and it is suggested that the question of immunity should be studied in this connection. Data on the relation of the colour of the animal to the degree of infestation by the flies are briefly discussed, but no general conclusion is reached. Particulars of the work done in individual counties, and statistics showing the numbers of injured and uninjured hides in various Scottish markets are given ; a comparison of some of the figures for 1930 and 1931 shows that there has been a considerable increase in injured hides.

DOANE (R. W.). **Common Pests.**—Large Cr. 8vo, viii+397 pp., 215 figs. Springfield, Ill., and Baltimore, Md., C. C. Thomas ; London, Baillière, Tindall & Cox, 1931. Price 21*s*. net.

The author collates in this handbook the essential facts regarding the commoner pests that directly affect man, his domestic animals, crops, storehouses and household, primarily with reference to the United States. Although it deals chiefly with insects, chapters are included on parasitic worms, mammals and birds ; practical methods of control are suggested wherever possible.

MARTINI (E.). **Breve introduccion a la entomologia medica.** [A brief Introduction to medical Entomology.]—*Med. Países calidos*, iv, no. 6, pp. 465–493, 3 pp. refs. Madrid, November 1931.

This is a survey of the more important insects that transmit disease to man or animals or otherwise injure them.

COMBIESCO (D.) & ZOTTA (G.). **Présence de la fièvre exanthématique de Marseille à Constantza (Roumanie). Observations cliniques et expérimentales sur le rôle de** *Rhipicephalus sanguineus* **dans la transmission.**—*C.R. Soc. Biol.*, cviii, no. 38, pp. 1279–1280, 2 refs. Paris, 1931.

Much of this information on an outbreak of Marseilles fever at Constantza and the evidence that it is transmitted by *Rhipicephalus sanguineus*, Latr., has already been noticed [*R.A.E.*, B, xx, 23], but the authors here record a case in which a tick was found attached to the body of an infant three days before the onset of the disease.

MARCANDIER (—), BIDEAU (—) & PIROT (R.). **Rôle possible du rat et de ses ectoparasites dans la transmission d'une forme atténuée du typhus exanthématique observée à bord des navires de guerre à Toulon.**—*Rev. Méd. Hyg. trop.*, xxiii, no. 6, pp. 299–305, 14 refs. Paris, 1931.

With a view to discovering the vector of a disease resembling Marseilles fever that occurs on warships at Toulon [*cf.* *R.A.E.*, B, xviii, 250], 247 rats (87 *Mus norvegicus* (*Rattus decumanus*) and 160 *M.* (*R.*) *rattus*) were caught on different ships between March 1929 and September 1931. *Polyplax* (*Haematopinus*) *spinulosa*, Burm., was found on 48 per cent. of the rats, but may be ignored, as it does not bite man. *Xenopsylla cheopis*, Roths., was found on 43 per cent. and *Ceratophyllus fasciatus*, Bosc, on 2 per cent. of the rats, and in view of recent experiments with Brill's disease in the United States [xix, 93, 221, 257], these fleas may be considered as possible vectors. *Dermanyssus muris*, Hirst, parasitised about 16 per cent. of the rats and was more abundant on *M. rattus*. The epidemiological evidence supporting the view that this mite may be the vector has already been noticed [xviii, 250]. The organisation of intensive rat destruction campaigns in the ships, which deprived the fleas and mites of their preferred hosts, coincided with the appearance of several cases of the disease.

DOVE (W. E.) & SHELMIRE (B.). **Tropical Rat Mites,** *Liponyssus bacoti* **Hirst, Vectors of Endemic Typhus.**—*J. Amer. Med. Ass.*, xcvii, pp. 1506–1510, 5 figs., 2 refs. Chicago, Ill., 21st November 1931.

Descriptions are given of a series of experiments undertaken to determine whether *Liponyssus bacoti*, Hirst, can act as a vector of endemic typhus [Brill's disease] in the United States [*cf.* *R.A.E.*, B, xix, 178]. Mites fed on a guineapig infected from man transmitted the disease to guineapigs and rats by bites, although in the latter case no symptoms were exhibited and infection was only demonstrated by inoculation of tissues from the rats into healthy guineapigs. Infection of guineapigs was also obtained by inoculation of crushed mites, and by the bites of larval mites obtained from females engorged on an infected guineapig.

MOOSER (H.), CASTANEDA (M. R.) & ZINSSER (M.). **Rats as Carriers of Mexican Typhus Fever.**—*J. Amer. Med. Ass.*, xcvii, no. 4, pp. 231–232. Chicago, Ill., 25th July 1931. (Abstracts in *Bull. Off. int. Hyg. publ.*, xxiii, no. 12, pp. 2194–2195. Paris, December 1931. *J. Trop. Med. Hyg.*, xxxv, no. 1, p. 12. London, 1st January 1932.)

A virus producing reactions typical of Mexican typhus fever [Brill's disease] in both guineapigs and rabbits has been recovered from the brains of rats (*Mus rattus*) taken in localities in Mexico during April and May when a moderate outbreak of the disease was in progress. It would thus appear that rats are reservoirs of the virus [*cf.* *R.A.E.*, B, xix, 93; xx, 24].

CEDER (E. T.), DYER (R. E.), RUMREICH (A.) & BADGER (L. F.). **Typhus Fever: Typhus Virus in Feces of infected Fleas** (*Xenopsylla cheopis*) **and Duration of Infectivity of Fleas.**—*Publ. Hlth. Rep.*, xlvi, no. 52, pp. 3103–3106, 2 charts, 3 refs. Washington, D.C., 25th December 1931.

In the first part of the paper details are given of experiments demonstrating the presence of the virus of endemic typhus [Brill's disease] in the faeces of infected individuals of *Xenopsylla cheopis*, Roths. [*R.A.E.*, B, xix, 257].

Experimental work on the virus shows that it may remain virulent in the flea for as long as 36 days after the last infecting feed. It seems probable that once a flea has become infected it may remain infective throughout its life. Negative results were obtained in experiments designed to recover the virus from fleas hatched from the eggs of infected fleas. Repeated attempts to transmit endemic typhus by feeding infected fleas on normal guineapigs through chiffon, so as to eliminate any part the faeces might play, were unsuccessful, whereas positive results were obtained when infected fleas were crushed and smeared on the abraded abdomen of healthy animals. It is therefore suggested that endemic typhus may be transmitted through the rubbing of infected faeces into wounds made by the biting of the flea or by scratching.

MAYNE (B.) & GRIFFITTS (T. H. D.). *Anopheles atropos* **D. & K.—a new potential Carrier of Malaria Organisms.**—*Publ. Hlth. Rep.*, xlvi, no. 52, pp. 3107–3115, 1 pl. Washington, D.C., 25th December 1931.

Adults of *Anopheles atropos*, D. & K., were captured on the persons of the collectors in a salt marsh in Mississippi in October–November 1931, and forwarded to Columbia, S.C., for infectivity experiments in cloth cages similar to those used by Barraud [*R.A.E.*, B, xvii, 255]. Nearly all the mosquitos survived the journey, showing the advantage of this type of cage over the metal cloth cages used for comparative purposes. Dissections of individuals fed on suitable carriers of *Plasmodium vivax* revealed infections in 85·7 per cent. The average percentage of infection in *A. quadrimaculatus*, Say, *A. punctipennis*, Say, and *A. crucians*, Wied., captured near Columbia and fed under the same conditions, was 55·2, and in a small number of *A. quadrimaculatus* collected in the same general region of the Gulf coast as *A. atropos* but maintained at a rather higher temperature it was 85·7.

A. atropos, which has been recorded from Mississippi, Louisiana, Alabama and Florida, is a strictly salt-marsh mosquito, the preferred breeding-places of which are shallow water on alluvial marshes, or permanent salt pools with a salinity (salinometer with direct salinity reading) of 3 to 21 per cent. It has been observed in large numbers in occupied rooms in hotels and houses within flight range of breeding-places. Close to its breeding-places it is known to attack in direct sunlight as well as at night, and it is an extremely persistent biter. Its morphology is discussed and the characters distinguishing the female from that of *A. walkeri*, Theo., which it closely resembles, are given from descriptions by Dyar [xvi, 167].

GRIFFITTS (T. H. D.) & GRIFFITTS (J. J.). **Mosquitoes transported by Airplanes. Staining Method used in determining their Importation.**—*Publ. Hlth. Rep.*, xlvi, no. 47, pp. 2775–2782, 2 pls. Washington, D.C., 20th November 1931.

In order to determine whether mosquitos are carried by aeroplane, 102 inspections were made, between 23rd July and 12th September 1931, of aeroplanes arriving at the airports of Miami, Florida, from localities in South and Central America, Mexico, and the West Indies. A total of 29 mosquitos were captured from 21 machines, comprising 1 male of *Aëdes argenteus*, Poir. (*aegypti*, auct.) and 28 individuals of *Culex fatigans*, Wied. (*quinquefasciatus*, Say). Since 18th September, examples of *Mansonia titillans*, Wlk., *Aëdes taeniorhynchus*, Wied., and *Anopheles albimanus*, Wied., have also been taken.

Adults of *A. argenteus*, together with a few *C. fatigans*, were stained with a 2 per cent. watery solution of yellowish eosin by means of an atomiser and were liberated in aeroplanes leaving San Juan, Porto Rico, on 13th, 16th and 18th September. Of 100 individuals liberated, 22 were recovered at Miami, 1,250 miles distant, in the afternoons of the days of departure. The average time taken for the journey was 10 hrs. 10 mins., of which 70 mins. were spent at intermediate landing fields. Though only 11 of the 22 mosquitos showed strongly positive reactions to the solvent used to show the presence of the stain, which consisted of 4 parts glycerine, 4 parts absolute alcohol and 1 part ether, it is practically certain that the others had not entered the aeroplane at intermediate landing places. One mosquito was observed biting during the flight of an aeroplane, at an altitude of approximately 3,000 feet. An apparatus in the nature of a small vacuum cleaner was used for collecting the mosquitos in the aeroplanes.

TWINN (C. R.). **Notes on the Biology of Mosquitoes of Eastern Canada.**—*Proc. 18th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1931*, pp. 10–22, 2 refs. New Brunswick, N.J., 1931.

Notes are given on the more important facts concerning the biology of the principal troublesome mosquitos of eastern Canada. These include many species of *Aëdes* that breed in temporary bodies of water. Those breeding in permanent water, which are considered far less important, include *Anopheles maculipennis*, Mg., *A. punctipennis*, Say, and *A. walkeri*, Theo. The first-named is a dangerous vector of malaria in many countries, but there is apparently little evidence of the occurrence of this disease at the present time in eastern Canada.

Gibson (A.). **Mosquito Suppression in Canada in 1930.**—*Proc. 18th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1931,* pp. 23–39. New Brunswick, N.J., 1931.

Investigations into the occurrence of mosquitos in Canada during 1930 are recorded under the various districts studied. Information on animal and plant enemies of mosquitos by C. R. Twinn has already been noticed [*R.A.E.*, B, xix, 148]. Tests carried out to determine the possibility of using petroleum extract of pyrethrum in the preparation of larvicidal dusts suitable for distribution by aeroplane showed that under insectary conditions, using shallow dishes, dust prepared by mixing an extract made from 1½ lb. pyrethrum in 1 gal. kerosene at the rate of 4 fl. oz. with 1 lb. kaolin or powdered gypsum destroyed the larvae of *Aëdes* within 24 hours. When kaolin was used, it sank, leaving a thin film of oil extract on the water surface, but the gypsum mixture formed a thin brittle crust on the surface, though some of it sank. Two fl. oz. of the same extract with 1 lb. of hydrated lime failed to kill the larvae of *Aëdes* under the same conditions. After being kept 6 weeks in a tightly closed container, the extract, when mixed at the rate of 5 fl. oz. to 1 lb. of hydrated lime and applied in a tray experiment at the equivalent of 90 lb. per acre, did not give satisfactory results against the larvae of *Culex*. In field tests, dusts prepared by mixing the extract with kaolin, hydrated lime and powdered gypsum in the proportion of 2 fl. oz. to 1 lb. were quite ineffective when applied at the rate of 65–70 lb. of the dust to the acre. In these tests the actual quantity of the extract used per acre was about three quarts, or one-third to one-sixth of that used by Ginsburg in his laboratory tests with oil-pyrethrum sprays [xix, 128].

Vannote (R. L.) & Ginsburg (J. M.). **Practical Application of Pyrethrum Mosquito Larvicide.**—*Proc. 18th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1931,* pp. 111–120, 1 fig., 2 refs. New Brunswick, N.J., 1931.

The kerosene-pyrethrum mosquito larvicide tested in 1929 [*R.A.E.*, B, xix, 128] was used on a large scale throughout the breeding season of 1930 in New Jersey. The stock emulsion was the same except that a little more soap was used for emulsification. It was diluted with water and sprayed on such breeding-places as sewage disposal plants [*cf.* xix, 102], standing pools, ponds, streams, etc. A dilution of 1 : 15 or lower was found to give complete kill of larvae and pupae and was harmless to fish, water-fowl and plant life. The larvicide remained effective for as long as fuel oil in moving streams and sewage disposal plants. On pools it was effective for about 60 hours and on polluted water for 36, whereas in these cases fuel oil is usually effective for at least 6 days.

Headlee (T. J.). **The Biology of the important economic Species of Mosquitos occurring in New Jersey.**—*Proc. 18th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1931,* pp. 40–69, 7 refs. New Brunswick, N.J., 1931.

In this paper considerable information is presented on the habits of the mosquitos of economic importance in New Jersey, which constitute only about one-fourth of the species occurring there. The various names under which each has been recorded are given, with a review of the published information concerning its habits and tables indicating the types of breeding-places noted in 1930. These reveal a much wider range of breeding-place than the literature would suggest. The outstanding difference between the water accumulations in the metropolitan district of north-eastern New Jersey now and a quarter of a century ago is the more general pollution of the natural waters with human waste, and this is suggested as the cause of the departure from the normal breeding-habits of certain species generally associated with upland swamps, houses and woodland pools. The data also indicate that the pollution factor is detrimental to the breeding of *Anopheles* spp., particularly *A. quadrimaculatus*, Say, which was unusually scarce in 1930. It is found that the problem of mosquito control is modified where it exists in an area of comparatively dense population [*cf. R.A.E.*, B, xix, 127]. Breeding of *Culex pipiens*, L., and of *Aëdes vexans*, Mg. (*sylvestris*, Theo.) may be reasonably anticipated in almost any kind of normal water accumulation and to a considerable extent the same may be said of *A. canadensis*, Theo. *A. cantator*, Coq., and *A. sollicitans*, Wlk., however, still maintain their primary relationship to the salt marsh. The seasonal succession of the mosquitos of a densely populated area apparently remains characteristically as it was under comparatively light density of population.

MILLER (F. W.). **A Summary of Mosquito Control Accomplishments in New Jersey during the past Year.**—*Proc. 18th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1931*, pp. 70–89. New Brunswick, N.J., 1931.

The seasonal incidence of mosquitos in various parts of New Jersey during 1930 is discussed, and the measures adopted against them are reported upon. A large motor shovel was used in some cases for digging ditches, and in others drains were opened up by means of gelatin dynamite and electric exploders. Electric pumping equipment was again used with good results. In order to obviate the unreliability of the human factor in hand collection of mosquitos, a light trap has been devised with which very good results were obtained ; these traps are to be tried on a larger scale. A special committee is being appointed to deal with the question of pollution of the normal waters by sewage discharge and its effect on mosquito breeding.

VAN DERWERKER (R.). **Mosquito Control Work : A Year-round Project.**—*Proc. 18th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1931*, pp. 90–100. New Brunswick, N.J., 1931.

The advantages of continuing mosquito control work throughout the winter months are discussed, and the type of work that has been and can be done during this period is outlined. In particular, the appearance of *Culex pipiens*, L., in great abundance can be considerably delayed by reducing the number of breeding-places available early in the season, and on soft, boggy and flooded swamps drainage work is much more easily done in frosty weather.

Griffitts (T. H. D.). **Mosquitoes of the southeastern United States and their economic Effects.**—*Proc. 18th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1931,* pp. 100–111. New Brunswick, N.J., 1931.

An annotated list is given of the 54 mosquitos recorded by Dyar [*R.A.E.*, B, xvi, 167] from the south-eastern United States, of which only about 12 are of any economic importance. They include *Anopheles quadrimaculatus*, Say, which breeds in ponds and acts as the chief malaria carrier of the region, *A. crucians*, Wied., and *A. punctipennis*, Say, being of very minor importance in this respect ; *Aëdes sollicitans*, Wlk., which breeds in salt meadows or marshes not reached by the daily tides (frequently in association with *A. taeniorhynchus*, Wied.), rendering large tracks of the coastal areas uninhabitable wastes ; *A. argenteus*, Poir. (*aegypti*, auct.), which is still very prevalent in the southern cities, towns and villages and is a potential danger as a carrier of yellow fever and dengue ; and *Culex fatigans*, Wied. (*quinquefasciatus*, Say), which breeds in contaminated water, being a great nuisance in houses, and carries filariasis.

[**Mosquito Control Work and Methods.**]—*Proc. 18th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1931,* pp. 121–124, 127–130, 146–148, 157–166. New Brunswick, N.J., 1931.

A series of brief reports on local anti-mosquito work in New Jersey and certain other States is given.

Other papers include : An outline of the various Inspection Methods employed by the County Mosquito Extermination Commissions, by J. B. Leslie (pp. 130–138), and Mosquito Control on Salt Marsh Areas under Industrial and Real Estate Development, by J. E. Brooks (pp. 150–157).

Hinman (E. H.). **The Winter Breeding and Activity of Culicine Mosquitoes at New Orleans (30°N. Lat.).**—*Amer. J. Trop. Med.*, xi, no. 6, pp. 459–467, 1 pl., 14 refs. Baltimore, Md., November 1931.

The following is taken from the author's summary : A periodic survey of breeding conditions of the Culicine mosquitos in New Orleans has been made from 25th September 1930 to 15th June 1931. A correlation of this data with meteorological statistics seems to indicate that after a monthly mean temperature of as low as 52·5° F. has been reached little outdoor breeding of *Aëdes argenteus*, Poir. (*aegypti*, auct.) is encountered. Indoor breeding of this species continues during even the coldest months and is of considerable significance in its over-wintering. *Culex fatigans*, Wied. (*quinquefasciatus*, Say) and *C. salinarius*, Coq., are apparently hardier species and continue development out-of-doors throughout the entire year, although oviposition may be suspended during part of January and February.

Bradley (G. H.). **Feeding Tests of Anopheline Mosquitoes with leguminous Plants.**—*J. Econ. Ent.*, xxiv, no. 6, pp. 1229–1233, 2 refs. Geneva, N.Y., December 1931.

A few experiments have been carried out in Louisiana in order to test a part of the theory that the absence of malaria in cultivated areas of Egypt is due to the extensive growing of clovers and other leguminous plants containing coumarin, which, it is claimed, may be capable of disinfecting mosquitos that become infected with malaria, or rendering them immune from such infection [*R.A.E.*, B, xvi, 26]. The data obtained indicate that mosquitos are not attracted to such plants and do not feed to any extent on either the blooms or foliage.

Even if it is admitted that coumarin can disinfect malaria-infected mosquitos [*cf.* *R.A.E.*, B, xviii, 143], experiments with *Anopheles quadrimaculatus*, Say, indicate that there is little, if any, likelihood of its ever obtaining this substance by feeding on leguminous plants. Records of experiments made to determine the influence of these plants in prolonging the life of freshly emerged *Culex fatigans*, Wied. (*quinquefasciatus*, Say) show no increase in length of life in their presence.

WELLS (R. W.). **Some Observations on electrified Screens and Traps.**—*J. Econ. Ent.*, xxiv, no. 6, pp. 1242–1247, 1 pl., 2 refs. Geneva, N.Y., December 1931.

Tests were carried out in Maryland during September 1930 to study the operation of electrified screens [*R.A.E.*, B, xix, 260] under different conditions in the control of house-flies and blow-flies and to compare the efficacy of electrified traps with that of the much-used traps of the cylinder type. A four-sided electrical trap was designed, each side of which was fitted with an electrified screen, 16 by 24 inches. Over the top of the trap was mounted a roof with extending eaves to protect the screens from rain. The transformer was mounted under this roof. The trap was mounted on a platform about 4 ft. from the ground, with side boards to collect the flies falling from the screens. For subsequent experiments, another trap was made by using only one of the electrified screens, fitting flush into the top of a box of the same lateral dimensions, and 6 inches deep. The bait pan was placed on the floor of the box and covered with a fly screen to prevent the electrocuted flies from falling into the bait. This box trap was mounted on the same platform. At a distance of 10 ft. from this platform was mounted a standard cylinder trap 18 ins. in diameter and 24 ins. high on a platform about 3 ft. high, baited in the same way as the electrical trap. Both traps were placed on the south side of a stable, under the shade of trees. A further electrified screen, 26 ins. by 36 ins., was installed in a window on the south side of a small building, about 30 yards from the other traps. The dead flies were caught in a receptacle built outside and below the window, and those falling inside were collected with a broom. The numbers of flies caught were estimated by weighing the catches and counting the flies in 10 gm. samples. All the traps were found to be capable of catching several thousand flies a day. Of the two types of bait used one consisted of 1 part of black cane molasses to 3 parts of water, together with 3 peeled bananas and skins, and the other of 1 lb. beef liver with water added to keep it moist. In two comparative tests the vertical electric trap killed more flies than were caught in the cylinder trap. In a third experiment in which the liver bait was used and the window screen was also operated, the window screen secured the largest catch, and the cylinder trap a larger one than the vertical electric. The experiments with the flat box electric trap gave very varying results, probably owing to different weather conditions during the two periods of test.

Among dead flies found at the windows of dairy barns equipped with an elaborate equipment of electrified screens were *Tabanus lineola*, F., and *T. sulcifrons*, Macq. The following species were represented in an average lot of 100 flies: *Musca domestica*, L., 69; *Stomoxys calcitrans*, L., 28; *Lucilia* sp., 1; *Phormia* sp., 1.

Although electric traps show great possibilities for the destruction of house-flies and blow-flies, cylinder traps have the advantage of requiring no shelter or current, are unaffected by rain, and are easily moved. The electric screen is a good destroyer, even without bait, in windows where litter from falling flies and the slight odour arising from their scorching are of no consideration. A few flies pass, apparently uninjured, through electrified screens when the latter are wet.

WELLS (R. W.). **The Method of Ingress of newly hatched Larvae of the Throat Bot of Horses,** *Gastrophilus nasalis* **L.**—*J. Econ. Ent.*, xxiv, no. 6, p. 1311. Geneva, N.Y., December 1931.

Eggs of *Gastrophilus nasalis*, L., clipped from the jaws of horses, were permitted to hatch in the laboratory. The newly hatched larvae placed on the jaws of horses made no attempt to pierce the skin, even when moistened with saliva or when on an area where the hair had been clipped. Almost invariably they migrated downward along the jaw toward the mouth, a few travelling a distance of about 4 inches and entering between the lips.

LANE (C.). **L'habitation dans ses rapports avec le paludisme (Résumé critique de la documentation ayant trait à cette question).**—C.H./Malaria/169, 48 pp., 8 pp. refs. Geneva, League of Nations, 1931. Also in English. Price 1*s*. 6*d*.

LANE (C.). **Housing and Malaria.**—*J. Trop. Med. Hyg.*, xxxiv, no. 24, pp. 405–411; xxxv, no. 1, pp. 4–12, 4 figs., num. refs. London, 15th December 1931; 1st January 1932.

This is a critical survey of the literature dealing with the part played by housing in relation to the propagation of malaria, the second paper being substantially a translation of the first.

The following is taken from the author's conclusions. The Anophelines associated by experience with the transmission of malaria are chiefly those that frequent houses and bite at night, a fact that suggests that housing is important in the transmission of malaria. This view is supported by observations on "malarious houses," in which one person after another acquires infection. At least in Europe such habitations possess dark, dirty and often damp portions. Fires in dwellings without chimneys are effective in driving out mosquitos, and it is suggested that in the past this fact must have widely influenced the incidence of malaria in Europe. After the invention of chimneys, houses were favourable to mosquitos until they were amply lighted. There is slight, though disputed, evidence that *Anopheles maculipennis*, Mg., may actually breed inside houses; it appears to be established that *A. stephensi*, List., will do so in Bombay. Infected Anophelines may be particularly associated with certain houses, and this may possibly be explained as showing a tropism towards food rather than as an instinct to return to a favourable shelter. If this is so, the necessity for abolishing all breeding-places near dwellings is emphasised, in order that no houses may become malarious because they attract infected Anophelines seeking a blood meal after oviposition. Certain species leave the house immediately after feeding, whereas others remain in it for some hours. There is, however, at least in Europe, North America and Brazil, a condition of gonotrophic dissociation, when the need to oviposit ceases, whereas the need to feed does not [*cf.* *R.A.E.*, B, xviii, 53]. Mosquitos in such a condition remain indoors, and may become infected and transmit malaria. There is some evidence that malaria may be pathogenic to mosquitos, thus providing a further reason for their failure to leave the house after becoming infected. There is no satisfactory evidence that malaria-carrying mosquitos prefer the blood of animals to that of man, or that airless animal sheds near human habitations necessarily protect man from the bites of mosquitos. It is suggested by inference that to house man well is likely to prove a better anti-malarial measure than to house animals badly. The success of such measures as the destruction of engorged and hibernating mosquitos stresses the connection between the house and malaria, and the proved effectiveness of screening shows that if mosquitos are prevented from entering houses, malaria can be avoided. All evidence points to the fact that it is in the house that malarial infection is essentially obtained. The manner in which infection may be controlled or fostered by placing dwellings far from or near to breeding-places of Anophelines lead to the same conclusion.

PULCHER (F.). **Comparsa di malaria primitiva nella città di Genova.** [The Appearance of primary Malaria in the City of Genoa.]—*Riv. Malariol.*, x, no. 4, pp. 459–464, 16 refs. Rome, 1931. (With Summaries in Italian, p. 538, French, p. 540, English, p. 542, German, p. 543.)

Two cases of malaria, apparently contracted locally, occurred in Genoa in 1930, after a period of many years of freedom from the disease. No adult Anophelines were found in September and October in the quarter of the city concerned, but irrigation tanks contained hundreds of mosquito larvae, including some of *Anopheles maculipennis*, Mg. These were taken about 280 yds. from the house where one of the cases occurred. Some persons with chronic malaria were also found.

MARTINI (E.), MISSIROLI (A.) & HACKETT (L. W.). **Versuche zum Rassenproblem des** *Anopheles maculipennis*. [Experiments on the Problem of Races of *A. maculipennis*.]—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 11, pp. 622–643, 5 figs. Leipzig, November 1931.

Examinations of the eggs of *Anopheles maculipennis*, Mg., were made in 1930 in Italy and in 1931 in Italy and Germany to ascertain if races of this species actually exist. The results indicate this to be highly probable, but further study is necessary. In Italy adults caught in various localities were kept in Rome for oviposition. The resultant eggs are classified as follows: Black or dark egg with a large float; banded egg with black cross band and large float; dark grey egg, marbled grey and dark, with medium sized float; almost entirely grey egg with small float; almost uniformly grey egg without float, which is that of *A. sacharovi*, Favr (*elutus*, Edw.). As these have presumably developed from one original form, the occurrence of occasional intermediate forms is to be expected. From Orti di Schito, where Anophelines are numerous in the absence of malaria, banded eggs only were obtained. In North Italy and near Viareggio the dark type predominates, except at Gorino, where the eggs are grey. In the Roman Campagna and in the Pontine Marshes the grey egg predominates, and half-grey eggs scarcely occur, whereas in North Italy they are commoner than the typical grey egg. As regards correlation with malaria, grey eggs and the disease increase towards the south of Italy, but in individual cases malaria and egg-type are not correlated.

The mosquitos taken in various parts of Germany were kept at Hamburg. There was a sharp difference, probably racial, between those producing half-grey eggs (*A. maculipennis* var. *labranchiae*, Falleroni) and those producing dark eggs (var. *messeae*, Falleroni) [*R.A.E.*, B, xv, 72]. Further investigation is needed to determine whether *messeae* is racially different from the form producing banded eggs (typical *maculipennis*). If a low water-temperature involves the production of banded eggs and if salinity favours the form *labranchiae*, it would be justifiable to conclude that the mosquitos producing banded or dark eggs are seasonal forms due to changes in water-temperature or variation in mineral content of water caused by seasonal rainfall. This means that records made at different seasons must be accepted with caution.

Various points relating to the question of races are discussed. As a rule, the mosquitos at Hamburg oviposited between 1 and 10 days after capture, those that oviposited quickly having apparently had several blood-meals. It would be a fact of great importance as regards malaria, and especially the concept of " malarious houses," if at temperatures of 22° C. [71·6° F.] (at which *Plasmodium vivax* matures in 10 days) the mosquito can carry eggs for 14 or more days, biting repeatedly during that period. Gonotrophic dissociation or semi-hibernation need no longer be involved as a cause of malaria transmission [*cf.* xviii, 53], for numerous mosquitos would also in summer remain long enough in houses to effect transmission. The fact that with *labranchiae* there is usually a longer interval between the blood-meal and oviposition indicates that this form is more dangerous in summer. It remains to be proved whether *labranchiae* and *messeae* are valid races in other countries. Even if they are only modifications, there still remains the fact that natural conditions, presumably during larval life, result in different eggs, and it is possible that different forms have a varying importance in the spread of malaria in the sense of Dutch workers [xviii, 52, 228, etc.].

ACHUNDOW (J.). **Die Fauna der Culicidae der Republik Aserbeidschan.** [The Culicid Fauna of the Republic of Azerbaijan.]—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 11, pp. 671–677, 3 figs., 10 refs. Leipzig, November 1931.

This is a series of notes on the geographical and seasonal distribution of mosquitos in Azerbaijan. *Anopheles maculipennis*, Mg., is an important and very widespread vector of malaria. Its larvae, which may be green, dark brown, or black, occur in clean and in somewhat dirty water, either alone or with those of *A. superpictus*, Grassi, *A. hyrcanus* var. *pseudopictus*, Grassi, and *Culex*. It predominates almost everywhere in spring and early summer, and in the Khachmas district throughout the summer, whereas elsewhere *A. superpictus* and *A. hyrcanus* var. *pseudopictus* increase during the latter period. Adults of *A. maculipennis* are commonest in animal quarters and least often found in houses away from them, but bite man in the absence of animals. *A. superpictus* is fairly widespread, the adults being numerous from mid-July onwards. It is an important vector of malaria, especially in the mountain region, as is *A. hyrcanus* var. *pseudopictus* in the plains. *A. bifurcatus*, L., and *A. pulcherrimus*, Theo., are local species of comparatively little importance. Only one individual of *A. plumbeus*, Steph. (*nigripes*, Staeg.) was found by the author.

The favourable temperatures in Azerbaijan in summer enable Anophelines to complete their life-cycle in a fortnight, so that there are possibly eight generations a year.

KODAMA (T.). **A Study of Methods for the Examination of Efficacy of various Larvicides.**—*J. Publ. Hlth. Ass., Japan*, vii, no. 8, pp. 1–2. August 1931. (Abstract in *Publ. Hlth. Engng. Abstr.*, xi, Ma. p. 40. Washington, D.C., 19th December 1931.)

The author has devised a new method for recording the reaction of insect larvae to chemical larvicides. The larva is suspended in water by a string, the upper end of which is attached to a straw lever. The movements of the larva are recorded by the straw working against a carbon paper. After the natural movement has been established, the larvicide to be tested is added. The author claims that both the intensity and time of reaction can be studied by the curve drawn.

HOLT (R. L.) & KINTNER (J. H.). **Notes on Dengue.**—*Philipp. J. Sci.*, xlvi, no. 4, pp. 593–598, 2 figs., 1 ref. Manila, 1931.

In an attempt to attenuate the virus of dengue, normal individuals of *Aëdes argenteus*, Poir. (*aegypti*, auct.) were fed on macerated infected mosquitos, using 50 infected individuals ground up in 1 cc. of non-immune blood. After an incubation period of 14 days, the fed mosquitos were ground up and used to infect another batch. Fourteen days after the third transfer, dengue was produced in a man by the bites of the mosquitos, and so far as could be ascertained the virulence of the virus had not been modified. Fourteen days after the fifth serial transfer, 145 mosquitos were allowed to bite a man subsequently proved to be susceptible, but dengue was not produced in 20 days, showing that the virus had either been lost or had become so attenuated as not to cause infection.

RUSSELL (P. F.). **Daytime resting Places of *Anopheles* Mosquitoes in the Philippines. First Report.**—*Philipp. J. Sci.*, xlvi, no. 4, pp. 639–648, 4 pls., 26 refs. Manila, 1931.

The difficulty of finding adult Anopheline mosquitos during the day is discussed from the literature and confirmed by personal experience. From routine weekly catches carried out at the end of 1930, it appears that in the Philippines the possible shelters examined for adults should include not only human habitations and animal sheds, but primarily natural hiding places, such as caves, cracks and crevices near or in the ground, not necessarily near breeding places.

KING (W. V.). **The Philippine Varieties of** *Anopheles gigas* **and** *Anopheles lindesayi.—Philipp. J. Sci.*, xlvi, no. 4, pp. 751–756, 2 pls., 13 refs. Manila, 1931.

Larvae of *Anopheles gigas* var. *formosus*, Ludl., were taken in 1929 and 1931 at an altitude of about 4,700 ft., along the grassy margins of pools in stream beds and on one occasion along the edge of a large rock in a well-shaded stream pool, on Luzon, Philippine Islands, the locality from which the species was originally described in 1909. It had not since been reported from the Philippines. *A. lindesayi* var. *benguetensis*, n., was obtained from the same locality. Notes are given on the characters of the adults of both these forms, and their larvae and male genitalia are described.

COVELL (G.) & BAILY (J. D.). **Malaria in Sind. Part IV. Malaria in Nawabshah District. Part V. Malaria in Umarkot and Chhachhro Talukas of Thar and Parkar District (Lower Sind). Part VI. Post-epidemic Conditions in a Rice-growing Area in Kambar Taluka, Larkana District. Part VII. Malaria in the Upper Sind Frontier District.**—*Rec. Malaria Surv. India*, ii, no. 4, pp. 507–568, 1 map, 5 refs. Calcutta, December 1931.

Accounts are given of further malaria surveys in various districts of Sind. As in the other areas surveyed [*R.A.E.*, B, xix, 43, 75], *Anopheles culicifacies*, Giles, is the most important if not the only vector of the disease.

MACDONALD (G.). **Report on a Malaria Survey in Bikaner State.**—*Rec. Malaria Surv. India*, ii, no. 4, pp. 603–619, 1 chart, 4 refs. Calcutta, December 1931.

A malaria survey of Bikaner City and certain outlying areas was carried out between 19th and 29th July 1931. The mosquitos encountered were *Anopheles culicifacies*, Giles, *A. subpictus*, Grassi, *A. fuliginosus*, Giles, *A. pulcherrimus*, Theo., and *A. stephensi*, List., the most important malaria vector, which was found breeding chiefly in clean water reservoirs, tanks and ornamental water.

RICHMOND (A. E.). **The Relation of Meteorological Conditions to Malaria Incidence amongst British Troops in Peshawar.**—*Rec. Malaria Surv. India*, ii, no. 4, pp. 621–642, 15 charts, 2 refs. Calcutta, December 1931.

An account is given of further work on the relation of meteorological conditions and malaria incidence in Peshawar [*R.A.E.*, B, xix, 42], taking into consideration the statistics for 1928, 1929 and 1930. There does not seem to be any great variation in prevalence of the two chief vectors, *Anopheles stephensi*, List., and *A. culicifacies*, Giles, from year to year, and it would appear that among the factors to be taken into account in the prediction of malaria epidemics, the Anopheline factor may be ignored to a large extent in this region. Humidity is the most important of the factors influencing the incidence of malaria amongst troops in the non-monsoon area of the North West Frontier Province, and the others combined do not, in the large majority of years, exert sufficient influence to detract materially from the value of the study of humidity as a guide to malaria incidence. The years when the incidence is high are characterised by the occurrence of one or more ten-day periods with an average humidity of over 80 per cent., and with the maximum average readings for such periods falling between the one commencing on 29th July and the one ending on 28th August annually; also by one or more ten-day periods with average humidities of more than 75 per cent. in or before that ending on 18th August. Conversely, malaria incidence is low in those years in which there is an absence of ten-day periods showing an average humidity of over 80 per cent., and in which the ten-day periods with an average humidity of 76–80 per cent. do not occur prior to the ten days ending on 28th August annually. It would thus appear that, by studying humidity, it is possible to predict by 28th August at the latest, and frequently considerably earlier, the onset of a good or bad malaria season, as distinct from an average one.

HERMITTE (L. C. D.). **Occurrence of** *Anopheles gambiae* (*costalis*) **in Aldabra Islands** (**Seychelles**).—*Rec. Malaria Surv. India*, ii, no. 4, pp. 643–654, 3 pls., 2 figs., 5 refs. Calcutta, December 1931.

The 92 islands that compose the Seychelles Colony have been reputed to be free from malaria and Anophelines, the only cases of the disease being among individuals coming from countries where they had contracted the infection. In 1908 an outbreak of malaria occurred in the Aldabra group, but no Anophelines were discovered. From that date no malaria was reported until 1930, when several cases occurred on the Islands of Assumption and Aldabra. No Anophelines were found on Assumption, but the time of search was very limited and took place at a dry season (February–April), and it is suggested that the mosquitos after being active during the rainy months (June–October) were undergoing a period of aestivation. At Aldabra, on the other hand, there had been a considerable amount of rain, the pools were full, and *Anopheles gambiae*, Giles, was found breeding in large numbers.

Measures put into force to prevent the introduction of Anophelines into the other islands include the fumigation of all ships from Assumption and Aldabra; and the evacuation of the latter island for a period of three months is proposed. The author discusses the problems arising from the unloading and treatment of cargoes, which is carried out in a manner allowing the escape of Anophelines before fumigation takes place, and points out in regard to the scheme of evacuation that not only is it uncertain that all infected Anophelines will die in three months, but also it would be extremely difficult to guarantee that no infected person would land on the island after its re-population. He points out the necessity for a practical campaign against the Anophelines on the infected islands and suggests that a survey of the mosquitos should be undertaken, together with a study of their biology in order to determine the most satisfactory measures for their extermination.

SWEET (W. C.) & RAO (B. A.). **Dissections of Female Anophelines in Mysore State.**—*Rec. Malaria Surv. India*, ii, no. 4, pp. 655–657. Calcutta, December 1931.

A table is given showing the details of dissections of over 30,000 Anophelines of about 20 species caught in Mysore State between 1st

October 1928 and 31st December 1930 ; malaria infections were found in *Anopheles culicifacies*, Giles, *A. stephensi*, List., and one mosquito the identity of which is uncertain.

TOUMANOFF (C.). **Sur la présence d'une variété d'*Anopheles jeyporiensis* James au Tonkin et son rôle dans la transmission locale du paludisme.**—*Bull. Soc. Path. exot.*, xxiv, no. 10, pp. 958–967, 8 figs., 8 refs. Paris, 1931.

The Anopheline described from Tonkin as *Anopheles aconitus* var. *tonkinensis*, Toumanoff [*R.A.E.*, B, xix, 183] has now been found to be a variety not of this species, but of *A. jeyporiensis*, James. A full description of it is to be published by Christophers, but the characters distinguishing the adults and larvae from those of *A. aconitus*, Dön., and *A. aconitus* var. *filipinae*, Mnlg., are given here.

This variety has been found in a number of localities in Tonkin, breeding chiefly in slowly running streams and in irrigation ditches with grassy edges and muddy bottoms, but also in small pools constantly replenished with clear water. The adults occur as frequently in houses as in stables. Of 50 individuals examined, one taken in April and two in May contained oöcysts. This variety may therefore constitute one of the local vectors of malaria.

On one occasion the larvae were found in association with those of *A. maculipalpis* var. *splendidus*, Koidz. (*indiensis*, Theo.) and *A. karwari*, James, neither of which has previously been recorded from Tonkin.

MORIN (H.) & MESNARD (J.). **Nouveaux faits relatifs à la réceptivité naturelle des anophèles d'Indochine à l'hématozoaire du paludisme.**—*Bull. Soc. Path. exot.*, xxiv, no. 10, pp. 919–923. Paris, 1931.

The authors point out the danger of adhering too rigidly to the theory that the ability to transmit malaria is strictly limited to certain species of *Anopheles*. *A. minimus*, Theo., is the domestic mosquito most frequently found naturally infected in Indo-China, but in addition to *A. aconitus*, Dön. [*R.A.E.*, B, xix, 225], *A. jeyporiensis* var. [*tonkinensis*, Toumanoff (see preceding paper)], *A. vagus*, Dön., *A. hyrcanus* var. *sinensis*, Wied., *A. kochi*, Dön., and *A. leucosphyrus*, Dön., have also been found naturally infected. The relatively large number of dissections carried out (in some cases more than a thousand) show a very low rate of infection among these species for the whole of Indo-China. Salivary gland infection was only observed in *A. vagus* and *A. aconitus*. There is some inconclusive evidence that such vectors may be of importance in certain localities and in certain seasons.

TOUMANOFF (C.). **Quelques observations sur la durée d'évolution larvaire des anophèles du Tonkin.**—*Bull. Soc. Path. exot.*, xxiv, no. 10, pp. 923–927. Paris, 1931.

A detailed account is given of observations on the length of the larval stage of several species of Anophelines in the laboratory at Hanoi. In the case of *Anopheles vagus*, Dön., the larval stage lasted for a minimum of 6 days in May at temperatures of 26–35° C. [78·8–

95° F.] and 7 days at the beginning of June at 27–34° C. [80·6–93·2° F.]. In the case of *A. hyrcanus* var. *sinensis*, Wied., at 27–35° C. and of *A. tessellatus*, Theo., at 27–34° C., the minimum in May was 7 days. These limits must be taken into account when organising regular anti-larval measures in Tonkin in May and June.

ROUBAUD (E.) & COLAS-BELCOUR (J.). **Etude sur les Ornithodores, du groupe** *lahorensis* **dans l'Afrique du Nord. Description d'***O. delanoëi* **n. sp.**—*Bull. Soc. Path. exot.*, xxiv, no. 10, pp. 948–957, 1 pl., 4 figs., 5 refs. Paris, 1931.

Ornithodorus delanoëi, sp. n., here described from the adult, was found in a porcupine burrow in Morocco in 1929 [*R.A.E.*, B, xvii, 122], but its description was delayed in order to determine by rearing whether its characters would remain constant. The features distinguishing this species, *O. foleyi*, Parr. [xvi, 265] and *O. lahorensis*, Neum., are discussed. In the course of this study, it was found that *O. franchinii*, Rondelli [xviii, 207] is a synonym of *O. foleyi*.

ZANETTI (V.). **Note préliminaire sur la lutte anti-malaria et anti-moustiques à Leopoldville.**—*Ann. Soc. belge Méd. trop.*, xi, no. 3, pp. 349–366, 4 diag., 4 graphs, 1 map. Brussels, August 1931.

The topography of Leopoldville, Belgian Congo, and the question of mosquitos in general is discussed. Temperature is sufficiently high all the year round to allow of oviposition and hatching, but during the dry season from the middle of May to the middle of September, the total number of possible breeding-places diminishes owing to lack of rain. The number of adults decreases markedly, but in the case of species of *Mansonia* (*Mansonioides*), the breeding-places of which are outside the inhabited region (probably in the marshes and along the rivers), there are periodical hatchings and subsequent invasion of the inhabited area by large numbers of adults.

Anti-larval control, which includes drainage, filling, etc., is confined to breeding-places of Anophelines, of which the most important species is *Anopheles gambiae*, Giles, and of *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.). The success of these measures is shown by a progressive diminution in the breeding-places containing Anopheline larvae, the number in 1930 being less than half that in 1927.

[SYMES (C. B.).] **Section of Medical Entomology.**—*Rep. Méd. Res. Lab. Kenya 1930*, pp. 27–29. Nairobi, 1931.

Additional Anophelines found during the year were *Anopheles garnhami*, Edw., *A. multicinctus*, Edw., and two forms near to *A. pitchfordi*, Giles, and *A. freetownensis*, Evans. Experiments with rats indicate that *Xenopsylla brasiliensis*, Baker, can transmit plague readily under certain conditions [*cf. R.A.E.*, B, xviii, 269].

GALLIARD (H.). **Les anophèles du Gabon occidental.**—*Rev. Méd. Hyg. trop.*, xxiii, no. 4, p. 187. Paris, 1931.

Of the Anophelines observed in the western part of Gabun, French Equatorial Africa, *Anopheles gambiae*, Giles, which occurs on the coast, *A. funestus*, Giles, which is found in the interior in the small areas of savannah, and *A. mauritianus*, Grp., which is abundant everywhere and is possibly the only forest species, were the most common, but *A. pharoensis*, Theo., and *A. marshalli*, Theo., also occurred. In the dry season, when the temperature falls, the adults could not be found. Reproduction, however, continues at a reduced rate, larvae of *A. mauritianus* occurring in the breeding-places that persist everywhere during this period. In the case of *A. funestus*, oviposition and larval development are more closely related to local variations in temperature.

EVANS (A. M.). **Observations made by Dr. M. A. Barber on a melanic, coastal Race of** *Anopheles costalis*, **Giles** (*gambiae*) **in Southern Nigeria.**—*Ann. Trop. Med. Paras.*, xxv, no. 3–4, pp. 443–453, 11 refs. Liverpool, December 1931.

The following is largely taken from the author's conclusions: A race of *Anopheles gambiae*, Giles (*costalis*, Theo.) capable of developing in normal time in water of a salinity at least equal to 46 per cent. sea water, as well as in fresh water, breeds in the coastal swamps near Lagos. The race is melanic, especially in the colouration of the integument of the adults and the pigmentation of the body and chitinous parts of the larvae, but the full degree of melanism is only developed when the larvae are reared in brackish water, or at least in water from the coastal swamps. Larvae hatched from eggs of *A. gambiae* from certain inland localities in southern Nigeria failed to develop in brackish water in which those of the coastal race matured successfully. Larvae hatching from eggs of *A. funestus*, Giles, originating from Abeokuta failed to develop in brackish water (slightly more than 46 per cent. sea water).

BARBER (M. A.) & OLINGER (M. T.). **Studies on Malaria in Southern Nigeria.**—*Ann. Trop. Med. Paras.*, xxv, no. 3–4, pp. 461–501, 3 figs., 1 map, 7 refs. Liverpool, December 1931.

Tables show the density (measured by the average number per room) of all Anophelines, and the infection rate in *Anopheles gambiae*, Giles (*costalis*, Theo.) together with the rainfall, in localities in the vicinity of Lagos (July 1929–January 1931) and at Ibadan (August 1930–January 1931), as well as the infection rate in *A. funestus*, Giles, and *A. hargreavesi*, Evans, at Ibadan. It is concluded that the Anopheline infection rate and consequently the malaria danger in this region are high in all months, but especially so in August and September. The peak of infection in September is probably correlated with the high Anopheline density in June and July and the rapid decrease in numbers in August. Infected mosquitos are widely distributed, and their infection rate varies greatly in different localities. Any valid comparison of the Anopheline infection rates of different regions of Africa must be based on large numbers and take into consideration locality and season.

Larvae or adults of the following species were found in the vicinity of Lagos: *A. gambiae*, *A. funestus*, *A. hargreavesi*, *A. moucheti* var. *nigeriensis*, Evans, *A. pharoensis*, Theo., *A. mauritianus*, Grp. (1 individual only), *A. mauritianus* var. *ziemanni*, Grünb., *A. mauritianus* var. *paludis*, Theo., *A. obscurus*, Grünb., *A. squamosus*, Theo., *A. nili*, Theo., and a coastal race of *A. gambiae*, possibly var. *melas*, Theo. The first four species, together with the coastal race of

A. gambiae, all occur in significant numbers, and their infection rates are high. The importance of *A. pharoensis* and *A. obscurus* in the transmission of malaria is more doubtful; possibly neither would be found infected in a region where there were no important vectors to maintain a high gametocyte rate. *A. obscurus* is widespread and breeds in localities difficult to treat by anti-mosquito measures.

Attempts to infect mosquitos in the laboratory with malignant tertian parasites [*Plasmodium falciparum*] were successful in the case of *A. gambiae* and dark varieties of it with four- and three-banded palps, *A. hargreavesi*, and *A. mauritianus* (probably var. *ziemanni*). Sporozoites were obtained in all except *A. mauritianus*, in which only two poorly developed oöcysts were found in one individual. Negative results were obtained with both varieties of *A. mauritianus* in several tests and also with *A. obscurus*, but in the latter case the batch was small and the results inconclusive. Notes are given on the species caught on man out-of-doors at night. *A. mauritianus* bites freely in the open, but is seldom found in dwellings, whereas *A. gambiae* rarely bites out-of-doors but constitutes the principal species found in houses. *A. hargreavesi* occupies an intermediate position. A study of the dispersion range of *A. gambiae* showed that it will migrate at least half a mile from a large breeding-place and probably more. A very low adult density index in this species seems to be adequate to maintain a high malaria rate. It seldom breeds in wells or water pots. It is pointed out that these conclusions are valid only for this region, where suitable breeding-places and an adequate blood supply are available almost everywhere.

Observations on the biology of Anophelines were undertaken in the vicinity of Lagos. The larvae of *A. gambiae* appear to be very adaptable to various breeding-places. They occur in fresh or brackish water, in sun or shade, in very shallow rain pools or at the margin of a large lagoon. They are absent in certain types of water that are apparently favourable and are scarce or absent in the large wooded or semi-wooded swamps that are common in this region, even when the water is partly exposed to the sun. Development from egg to adult took 7–8 days in ponds or shallow pools exposed to the sun. Females will bite freely during the morning following emergence, and sporozoites may be found in the salivary glands 9 days after feeding. Thus the minimum time between the hatching of eggs and the production of sporozoites is only 16–17 days. The swamps in which the dark, coastal race of *A. gambiae* [see preceding paper] develop are fresh during the greater part of the rainy season and brackish (about 46 per cent. sea water) during the dry season. They are scarcely above sea-level and are commonly covered with a coarse grass. During both seasons the water of these swamps in many places overlies a very black, thin mud not commonly found inland. Black larvae of *A. gambiae* were only occasionally found far inland, and typical dark adults were never bred from them.

Streams of the type normally harbouring *A. funestus* are rare in the coastal region, and this species is relatively uncommon. Larvae were most plentiful in a pond open to the sun and abundantly supplied with dead grass. They also occurred more rarely in partly wooded swamps, in pools covered with *Pistia*, in muddy ditches, and in a large clear river. *A. hargreavesi* was most numerous in certain pools covered with *Pistia*, and less common in grassy swamps. *A. moucheti* var. *nigeriensis* occurred sparingly in partly wooded swamps and a river. Brief notes are also given on the breeding-places of the less important species.

The surveys indicate that hardly any type of water except the sea is free from mosquito-breeding. The large wooded swamps, containing fresh water and covering many hundreds of acres of coastal plain, would seem to be the least dangerous, because they rarely harbour *A. gambiae* or *A. funestus*. It is concluded that for many years to come any extensive anti-larval measures will probably have to be confined to the protection of towns or other limited areas. The more permanent measures such as drainage and filling appear to be the ones best suited to conditions in West Africa.

MOHAMMED (Abdel Shafi). **The Transmission of Human and Bovine Onchocerciasis.**—*Ann. Trop. Med. Paras.*, xxv, no. 3–4, pp. 509–519, 2 refs. Liverpool, December 1931.

The author reviews the literature on the infestation of man and cattle by *Onchocerca* in various parts of the world and suggests that, as Simuliids have been found to be the vectors in other regions, an exhaustive survey of the different species of *Simulium* in Australia, together with experiments on their ability to transmit *Onchocerca gibsoni*, might solve the problem of transmission of this parasite and so save annually the large sums that are being lost through infestation of cattle by it.

CONNAL (A.). **Report of the Laboratory Service, 1930.**—*Ann. Med. Hlth. Rep. Nigeria, 1930*, pp. 71–97. Lagos [1931].

In the course of routine examination of rats for fleas, three females of *Xenopsylla aequisetosa*, End., were taken from dead rats; this is the first record of this species from rats in Lagos.

Information on mosquitos is reported in the section on entomology by S. L. M. Connal (pp. 78–80). In experiments with mosquitos fed on a man showing a light infection of *Filaria* (*Wuchereria*) *bancrofti*, the following gave positive results: *Mansonia* (*Taeniorhynchus*) *africanus*, Theo. (of which 56·57 per cent. were infected when fed at night and 34·83 per cent. when fed in the morning), *Anopheles gambiae*, Giles (of which 44·92 per cent. were infected at night and 7·69 per cent. in the morning), *Aëdes argenteus*, Poir. (of which 33·96 per cent. were infected at night and none in the morning), single individuals of *Anopheles pharoensis*, Theo., *A. marshalli*, Theo., and *Lutzia tigripes*, Grp., and one out of three of *A. mauritianus*, Grp. Negative results were obtained with 6 individuals of *Culex fatigans*, Wied., 3 of *Aëdes* (*Banksinella*) *luteolateralis*, Theo., 2 of *A. africanus*, Theo., and 1 of *Eretmopodites chrysogaster*, Graham. The higher rate of infection in *M. africanus* is probably due to its greater capacity and avidity for blood, and the lower rate of infection resulting from morning feeds can be explained by the smaller number of embryos of the parasites present in the blood at this time. In *A. gambiae* the parasite reached the stage of entering the proboscis after a period of 12 days, but the developmental forms seen up to 15 days in *M. africanus* and 9 in *A. argenteus* corresponded to those 2–3 days old as seen in *A. gambiae*. Thus it would appear that in these two species the larval forms of the parasite, although remaining alive and active, did not develop after the third day. The single individuals of the other species infected showed forms typical of the period of development.

LESTER (H. M. O.). **Report of Tsetse Investigation, 1930.**—*Ann. Med. Hlth. Rep. Nigeria 1930*, pp. 101–109. Lagos [1931].

Of the large numbers of puparia of *Glossina morsitans*, Westw., and *G. tachinoides*, Westw., collected in the Sherifuri district during 1929–30, only a small percentage was parasitised by the Bombyliid, *Thyridanthrax argentifrons*, Aust., and a still smaller number by *Stomatoceras micans*, Wtrst.

The experimental clearings described in previous reports [*R.A.E.*, B, xviii, 202; xix, 79] are being maintained in their present condition by annual slashing of re-growth. No extension of the area is being undertaken, although experiments in clearing methods are being continued. Estimates of the densities of *G. morsitans* and *G. tachinoides* in the experimental area are being made annually. The records obtained in April and October 1930 showed no appreciable change from those of the preceding two years; the fly density thus appears to be stationary.

AVÉ LALLEMANT (G. F. H.), SOERONO (M.) & SOEKARIA (M. S.). **Experiments about the Flying Radius of some** *Anopheles*.—*Meded. Dienst Volksgezondh. Ned.-Ind.*, Foreign Edn., xx, pt. 1, pp. 12–25, 1 map, 1 graph, 11 refs. Batavia, 1931.

A survey is given of published work on the range of flight of Anophelines in various parts of the world, and experiments in Java are described in detail. They were carried out from 30th June to 24th July 1930 at a place where local conditions allowed for free flight in every direction. Stained mosquitos were recaptured in buffalo sheds at the following distances from the point of release: one *Anopheles aconitus*, Dön., at 600 yards; one *A. kochi*, Dön., at 500; one *A. fuliginosus*, Giles, at 275; six *A. hyrcanus* var. *sinensis*, Wied., at 220, 275, 440 (two), 550 and 880 respectively; two *A. subpictus*, Grassi (*rossi*, Giles) at 220; two *A. vagus*, Dön., at 220 and 660 respectively; and three *A. barbirostris*, Wulp, at 220, 275 and 330 respectively. It is probable that longer distances can be covered by the mosquitos. *A. subpictus* occurs in considerable numbers only between 8 and 10 p.m. *A. hyrcanus* var. *sinensis* and *A. barbirostris* are most numerous between 7 and 8 p.m. *A. aconitus* and *A. fuliginosus* are abundant after 8 p.m. and remain so during the first part of the night. *A. vagus*, *A. kochi* and *A. tessellatus*, Theo., are all found in equal numbers during the first part of the night.

KOPSTEIN (F.). **Rats and Ratfleas of Java. A Guide for identifying the Species concerned in the Study of the Epidemiology of Plague.**—*Meded. Dienst Volksgezondh. Ned.-Ind.*, Foreign Edn., xx, pt. 1, pp. 35–72, 18 figs., 25 refs. Batavia, 1931.

Descriptions are given of the rats likely to be concerned in outbreaks of plague in man in Java, with a brief discussion of their relative importance and nomenclature, and a key to the species. The shrews are also briefly discussed.

Lists are given of the fleas recorded from Java, Sumatra, Borneo, and Celebes and of those occurring on rats, with notes on flea morphology, and descriptions of *Xenopsylla astia*, Roths., *X. cheopis*, Roths., and *Stivalius cognatus*, Jord. & Roths., which is the flea commonly known in Java as *S.* (*Pygiopsylla*) *ahalae*, Roths.

Kopstein (F.). **Die Oekologie der javanischen Siphonapteren und ihre Bedeutung für die epidemiologie der Pest.** [The Ecology of Siphonaptera of Java and their Importance in the Epidemiology of Plague.]—*Z. Morph. Oekol. Tiere*, xxiv, no. 2, pp. 408–434, 32 refs. Berlin, 11th January 1932.

A list is given of the 12 known species of fleas of Java with their hosts and distribution in the Island. Of the six that have been taken on rats and shrews, which include *Xenopsylla cheopis*, Roths, *X. astia*, Roths., *Stivalius cognatus*, Jord. & Roths., and *Neopsylla sondaica*, Jord., *X. cheopis*, which is common throughout Java, is the most important vector of plague.

Papers noticed by Title only.

[Kalmuikov (E. S.).] **Калмыков (Е. С.). Materials relating to the Phenology of** *Anopheles maculipennis* **Mg.** [*In Russian.*]—*Bull. Inst. Controlling Pests & Diseases*, no. 1, pp. 101–119, 7 figs., 33 refs. Leningrad, 1931. (With a Summary in English.) [*Cf. R.A.E.*, B, xix, 168.]

Martini (E.). **Die Rassenfrage bei** *Anopheles maculipennis*. **Ein kritisches Sammelreferat.** [The Question of Races of *A. maculipennis*. A critical Review of the Literature.]—*Arch. Schiffs- u. Tropenhyg.*, xxxv, no. 12, pp. 707–733, 6 pp. refs. Leipzig, December 1931.

Salem (Hassan Hilmy). **Some Observations on the Structure of the Mouth Parts and Fore-intestine of the fourth Stage Larva of** *Aëdes* (*Stegomyia*) *fasciata* (**Fab.**) [*argenteus*, Poir.].—*Ann. Trop. Med. Paras.*, xxv, no. 3–4, pp. 393–419, 14 figs., 22 refs. Liverpool, December 1931.

Evans (A. M.). **A new Subspecies** [*leesoni*] **of** *Anopheles funestus* **Giles, from Southern Rhodesia.**—*Ann. Trop. Med. Paras.*, xxv, no. 3–4, pp. 545–549, 8 refs. Liverpool, December 1931.

Carpano (M.). **African Horse Sickness as observed particularly in Egypt and Erithrea.**—*Bull. Minist. Agric.* [*Egypt*], no. 115, 41 pp., 1 pl., 1 map, 2 graphs, 29 refs. Cairo, 1931. [Translation of a paper already noticed, *R.A.E.*, B, xviii, 243.]

Scott (H.). **Some Nycteribiidae from the Australian Region. Part II: On certain Species of** *Cyclopodia.*—*Stylops*, i, pt. 2, pp. 25–30, 3 figs. London, 15th February 1932.

da Costa Lima (A.). **Sobre as especies de** *Megarhinus* **do Brasil.** [Brazilian Species of *Megarhinus*.]—*Mem. Inst. Oswaldo Cruz*, xxv, fasc. 4, pp. 307–315, 2 pls., 6 refs. Rio de Janeiro, 1931.

Liggett (H.). **Parasitic Infestation of the Nose** [by larvae of *Attagenus piceus*, Ol., in U.S.A.].—*J. Amer. Med. Ass.*, xcvi, no. 19, pp. 1571–1572, 1 fig., 4 refs. New York, 9th May 1931. (Abstract in *Trop. Dis. Bull.*, xxix, no. 2, p. 155. London, February 1932.)

Doorenbos (W. B.). **Eenige ervaringen op malariagebied.** [Some Experiences relating to Malaria.]—*Geneesk. Tidjschr. Ned.-Ind.*, lxxi, no. 18, pp. 1458–1478, 10 refs. Batavia, 15th December 1931. (With a Summary in English.)

These observations on the East Coast of Sumatra do not include the tracts of brackish water near the shore that are the breeding-places of *Anopheles ludlowi*, Theo., a most important vector of malaria. The classification of 243,137 Anophelines caught and the result of 80,667 dissections are described. The following mosquitos harboured oöcysts of malaria, the figures showing the numbers dissected and the percentage of infection in them: *A. maculatus*, Theo. (6,890) 2·8 per cent.; *A. hyrcanus* var. *sinensis*, Wied. (14,163) 0·7; *A. kochi*, Dön. (8,929) 0·75; *A. aconitus*, Dön. (3,032) 0·2; and *A. leucosphyrus*, Dön. (504) 1.

Notes are given on the habitats and seasonal occurrence of these mosquitos and of *A. barbirostris*, Wulp, *A. vagus*, Dön., *A. umbrosus*, Theo., *A. punctulatus*, Dön., *A. fuliginosus*, Giles, *A. karwari*, James, *A. albotaeniatus*, Theo., and *A. aitkeni*, James. *A. maculatus* usually becomes abundant at the end of the rainy season, which extends from September to December. It is found in dwellings, breeds chiefly in running water, and is the vector of malaria in hilly country with ravines. To control it, ravines should be cleared and provided with underground drainage, and all waters should be regularly oiled or dusted with Paris green. *A. hyrcanus* var. *sinensis* is also most noticeable at the end of the rains. It breeds in stagnant water in flat, open country, and is common in dwellings. This and the other mosquitos that breed in still water may be controlled by providing good outlets for the water or by using oil or Paris green. *A. kochi* breeds in shaded stagnant water and is very numerous in the rainy season. It is common in dwellings and is the ordinary carrier of malaria in the old rubber woods in ground difficult to drain. *A. aconitus* appears to be typically seasonal, for even at times of the year when it is rare suitable breeding places are available. It is very numerous from May to September in hilly country, also occurring in dwellings. It may be controlled in the same way as *A. maculatus*. *A. leucosphyrus* breeds in still water in shaded, hilly ground and is therefore distinctly associated with the rainy season. It is very rare in dwellings and is primarily a forest mosquito, occurring in dense rubber woods.

Paris green containing 55 per cent. As_2O_3 proved an excellent larvicide; if carefully applied, it is even valuable in hilly country, but supervision must be efficient. Work against the mosquitos combined with treatment with plasmochin has kept malaria under control.

Senevet (G.). **Contribution à l'étude des nymphes de culicides. Descriptions de celles de certains anophélinés et plus spécialement des espèces européennes et méditerranéennes.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 69–154, 48 figs. Algiers, 1931.

From a study of the pupae of 30 species of *Anopheles*, the author has drawn up a general scheme for the identification of the different species based almost exclusively on the chaetotaxy. Descriptions are given of the pupae of *Anopheles sergenti*, Theo., *funestus*, Giles, *listoni*, List., *hispaniola*, Theo., *multicolor*, Camb., *superpictus*, Grassi, *theileri*, Edw., *stephensi*, List., *pretoriensis*, Theo., *maculipalpis*, Giles, *squamosus*, Theo., *punctulatus*, Dön., *marteri*, Sen. & Prun., *plumbeus*, Steph., *bifurcatus*, L., *eiseni*, Coq., *punctipennis*, Say, *hyrcanus*, Pall., *separatus*, Leic., *umbrosus*, Theo., *barbirostris*, Wulp, *implexus*, Theo., and *maculipennis*, Mg., with a key, divided into *Anopheles* and *Myzomyia*, which also includes *mauritianus*, Grp., *pharoensis*, Theo., *marshalli*, Theo., *nili*, Theo., *sacharovi*, Favr (*elutus*, Edw.), *algeriensis*, Theo., and *rhodesiensis*, Theo., the pupae of which have already been described, and a second key including only European and Mediterranean species.

MARTINI (E.). **Ueber die Flugweite der Anophelen.** [On the Range of Flight of Anophelines.]—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 226–241. Algiers, 1931.

Recorded data on this subject are given and discussed. The author's observations in winter in the marsh districts of the Elbe estuary showed that females of *Anopheles maculipennis*, Mg., were far more numerous in houses on high ground removed from breeding-places than in houses on marshland where breeding-places were abundant. This is explained by Reitler's observations of the hibernation flight of the females [of *A. sacharovi*, Favr] near Lake Huleh, Palestine [*R.A.E.*, B, xvii, 156]. In Russia the author observed a sudden, extraordinary mass occurrence of both sexes of *A. maculipennis*, with no adequate breeding-places within about 3 miles. Wind-carriage was responsible for this importation in one night.

Three types of flight of *A. maculipennis* may be recognised: the hibernation flight of the females undertaken to escape from low ground threatened by floods to higher situations; the migration flight by both sexes, often with the wind, when there is overcrowding at the breeding-places; and the daily flight in quest of food, shelter, breeding-places, and opportunity for mating.

EKBLOM (T.) & STRÖMAN (R.). **Geographical and Biological Studies on the Swedish Anophelines from an Epidemiological Point of View.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 256–276, 9 figs. Algiers, 1931.

EKBLOM (T.) & STRÖMAN (R.). **Geographical and Biological Studies of** *Anopheles maculipennis* **in Sweden from an Epidemiological Point of View.**—*K. Svenska Vetenskapsakad. Handl.*, (3) xi, no. 1, pp. 1–113, 28 figs., 6 pp. refs. Stockholm, 1932.

Serious outbreaks of malaria occurring in several countries in Europe during and after the War led to the apprehension of a general spread of the disease. In Sweden it had formerly been common, but practically disappeared before the beginning of the present century, and little was known of the biology and distribution of the Anopheline vectors. Detailed investigations were therefore carried out from 1924 to 1929, and in the first paper a condensed account is given of the results obtained, including information on the bionomics and distribution of *Anopheles maculipennis*, Mg., that is dealt with in great detail in the second paper.

The following is taken largely from the authors' summary of the first paper: *A. maculipennis* is widely distributed in the central and southern part of the country, but in the east is confined to a narrow zone along the Gulf of Bothnia. It is most numerous round the great central lakes. *A. bifurcatus*, L., is not so abundant as *A. maculipennis* and does not extend so far north; it is chiefly found on the banks and in the vicinity of the central lakes. About a century ago these mosquitos were more widely distributed in the western part of Norrland, owing to the higher summer temperatures that prevailed at that time.

A. maculipennis has two overlapping generations a year. The adults of the summer generation appear from June to September and live for 1–4 weeks, whereas those of the winter generation occur from July to June and live 6–10 months. In spring the life-cycle takes 60 days and in summer only 30. *A. bifurcatus* also has two generations a year, but hibernates in the larval stage. Thus the adults are only seen during the warm weather from May to September, when they live for 8–30 days. In summer both species are active between dusk and dawn, but in spring and autumn they are on the wing during the day, when the temperature is more suitable.

From a consideration of the distribution of malaria in former years and the area in which the Anophelines are now present, it would appear that *A. maculipennis* was the principal vector. The reasons for the spontaneous disappearance of malaria from Sweden are discussed. It appears to be accounted for, at least in part, by an increase in cattle breeding and a consequent tendency on the part of the mosquitos to attack animals, but that this tendency is connected with the number of maxillary teeth [*cf. R.A.E.*, B, xvi, 210, etc.] is regarded as problematical. Examination of Swedish examples of *A. maculipennis* showed that the average number of teeth is 17·8, a figure that, according to Roubaud's theory [*loc. cit.*], would denote that there is a shortage of animal hosts other than man. This is not the case. The authors consider that Martini's views [x, 229] are more likely to be correct; they are confirmed by the fact that in the parts of the infested area in Sweden where summer temperatures are low, the average maxillary index is highest. Moreover, if Roubaud's theory were correct, the number of teeth should have been lower during the period when malaria was common and the mosquitos attacked man more frequently, but an examination of the maxillary armature of 8 museum specimens collected from various parts of Sweden at the beginning of the 19th century showed an average of 17·1, so that no apparent change has taken place in the morphology of *A. maculipennis* during the past 100 years.

BARBIERI (A.) & CAZES IRIGOYEN (A.). **El paludismo y los factores meteorologicos en la Republica Argentina. Su epidemiologia.** [Malaria and meteorological Factors in Argentina. Its Epidemiology.]—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 423–429. Algiers, 1931.

In Argentina, endemic malaria occurs in the north-western provinces, a mountainous region with subtropical vegetation, and is associated with *Anopheles pseudopunctipennis*, Theo. [*cf. R.A.E.*, B, xvi, 145]. This is the chief vector in Argentina, *A. argyritarsis*, R.-D., and *A. albimanus*, Wied., being less important. *A. albitarsis*, Arrib., and *A. tarsimaculatus*, Goeldi, occur on the east coast and can only be considered occasional vectors. Epidemics of malaria, both within and without the endemic zone, are connected with abnormal, cyclical rises in temperature and abundant rainfall. These factors favourable to mosquito life correspond to a minimum or total absence of sunspots, according to records since 1900 [*cf. R.A.E.*, A, xx, 52].

Rivero-Saldivia (H.). **Observations sur le paludisme au Venezuela.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 289–292. Algiers, 1931.

The information contained in this paper on the Anophelines of Venezuela is almost identical with that noticed from another source [*R.A.E.*, B, xvii, 108]. The author points out that about 50 years ago malaria was unknown in certain towns of the plain of Guarico, and although persons in charge of flocks visiting the vicinity of the River Orinoco frequently returned infected with malaria, the cases remained sporadic. For 30 years or more, however, this region has suffered intensely from malaria, and certain villages have been abandoned. The invasion took place from south to north. Mosquitos have always been present in the past and seem recently to have even disappeared in some localities.

Morin (H. G. S.). **Recherches sur le paludisme des " terres rouges " de Cochinchine.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 459–463. Algiers, 1931.

The author discusses malaria in the red soil regions of Cochin China, and concludes that *Anopheles minimus*, Theo., is certainly a vector and that *A. maculatus*, Theo., is probably concerned in the transmission of the disease [*R.A.E.*, B, xix, 50]. Owing, however, to the numerous species of Anophelines present in this region, these conclusions should be limited to localities that have been the subject of detailed study, and the factors bearing on the problem of epidemiology must be determined for each individual area [*cf.* xx, 62, etc.].

Sur (S. N.). **Malaria Problem in Bengal.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 464–486, 2 maps. Algiers, 1931.

Details are given of collections and dissections of Anophelines in the Nadia District of Bengal, which demonstrate that *Anopheles philippinensis*, Ludl., *A. fuliginosus*, Giles, and *A. pallidus*, Theo., are not only the sole species found to be naturally infected, but are also the most numerous group in one of the hyper-endemic areas of the very malarious region of west and central Bengal. They develop in all but very foul waters, ideal breeding-places being water collections covered with vegetation, such as reservoirs or " dead " rivers, or rice-fields with 2–6 ins. of standing water in them. In such cases breeding takes place not only at the edges but over the entire surface.

From the point of view of malaria, Bengal may be divided into five regions. Rice is grown everywhere, and, except in the submontane region, is the principal crop. The submontane region, where Anopheline vectors breed in the hill streams and terraced rice-fields, is extremely malarious. The disease appears in May and attains its maximum incidence in August, when the monsoon reaches its height and the swiftness of the current in the streams renders them unfit for larval development. The second region is traversed by larger streams formed from the smaller ones mentioned above, and after rain the larvae are swept away by the large volume of silty water that floods the surrounding country where it is not protected by embankments. Malaria is less intense in the unprotected areas. In the tract of flat country, where the streams become large rivers, the flood water during the monsoon remains almost permanently high, varying in depth from 1 to 15 ft., and a very long-stemmed variety of rice is grown. This region is not yet protected by embankments and in consequence is very fertile and has a low malarial incidence. The part of the country near the sea is subject to tidal influence, and though the water in the rice-fields is not so high as in the previously mentioned tract, it is usually sufficient to obliterate the boundaries, which are 9–12 ins. high, and little malaria occurs. *A. fuliginosus*, *A. listoni*, List., and *A. barbirostris*, Wulp, have, however, been found breeding in rice-fields where the water is only 2–6 ins. deep and the boundaries are visible. In the fifth region, which covers the greater part of west and central Bengal, the canals and channels are blocked or silted up, the land is not subject to flooding and the rice-fields contain only 2–6 ins. water and thus provide ideal breeding-places during the monsoon, which corresponds to the malaria season. Primary cases begin to appear in July, and the maximum incidence is reached in November. Land suitable for the early rice crop is generally high, and the water does not stand in the fields sufficiently long for the larvae to complete their development.

FRANCHINI (G.). **Malaria e risaia.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 523–526. Algiers, 1931. (With a Summary in French.)

A four years' study of malaria in the Province of Bologna showed that cases of the disease (which are not numerous) are almost exclusively recorded from the rice-growing areas, where *Anopheles maculipennis*, Mg. (*claviger*, auct.), *A. hyrcanus* var. *pseudopictus*, Grassi, and *A. sacharovi*, Favr (*elutus*, Edw.) are very numerous. The presence of malaria in these localities is thought to be due to the comparative absence of cattle, for, in adjacent areas of dry cultivation where cattle are more numerous, the disease does not occur.

FRANCHINI (G.). **Appunti di malariologia sulle colonie italiane et sugli agenti trasmissori.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 555–558. Algiers, 1931. (With a Summary in French.)

The incidence of malaria in the Italian Colonies and the species of Anophelines that may act as vectors are briefly discussed. In Tripoli the disease is not very common. *Anopheles mauritianus*, Grp., and *A. algeriensis*, Theo., occur in Taouorga [*R.A.E.*, B, xvii, 144], and *A. maculipennis*, Mg. (*claviger* auct.) in the other malarious localities. Indigenous malaria is rare in Cyrenaica ; *A. hyrcanus* var. *pseudopictus*, Grassi, and *A. multicolor*, Camb., have been taken in this region. In Eritrea malaria is widely distributed, the intensity varying with the locality and the season ; the Anophelines are *A. gambiae*, Giles (*costalis*, Theo.) and *A. mauritianus*. In Italian Somaliland malaria is prevalent, except in the coastal zone ; *A. gambiae* and *A. funestus*, Giles, are the Anophelines recorded.

ROUBAUD (E.). **Sur les avantages et conditions d'emploi des poudres antilarves.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, ii, pp. 39–44. Algiers, 1931.

The toxic action on mosquito larvae of insoluble dusts, such as trioxymethylene, Paris green, etc., depends on their ingestion, and as very young larvae and those about to pupate do not feed, the immediate results obtained by dusting cannot compare with those obtained by the application of oils, which act more or less mechanically on all stages of larvae and on pupae. Moreover, the effectiveness of dusting is also liable to be influenced by high winds, rain, etc. On the other hand these disadvantages may be considerably reduced by repeated applications at regular intervals. Against Anopheline larvae, dusts are more easily distributed than oils on grassy surfaces and over large areas. The most important point in their favour is, however, the fact that they exercise no repellent action on ovipositing females, which are not therefore forced to seek other breeding-places, possibly outside the treated area.

A receptacle in which *Culex pipiens*, L., was breeding was oiled at intervals of 7–10 days for 52 days. The larvicidal action was perfect, and only 5 egg rafts, representing about 1,000 larvae (which did not develop) were deposited on the treated surface throughout the period. Another receptacle containing many larvae of *C. pipiens* and a certain number of larvae of *Anopheles maculipennis*, Mg., was treated every 7 days with Stoxal [*R.A.E.*, B, xvi, 63, etc.]. Every morning the egg rafts deposited overnight were collected, counted, and the larvae hatching from them replaced. During the 52 days of the experiment 210 egg rafts each comprising some 250–300 eggs, corresponding to about 55,000 larvae, were laid in the basin treated with Stoxal. Throughout the period of treatment living larvae could always be seen. In spite of this only about 60 larvae pupated and only 8 adult mosquitos (all females of *C. pipiens*) emerged. The ultimate result obtained by dusting showed it to have destroyed more than 50 times as many larvae as oiling. Thus, unless the whole of the breeding-places can with certainty be effectively treated with oil, it is preferable to use dusts or a combination of the two treatments.

COPANARIS (P.). **Rapport sur le paludisme en Grèce.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, ii, pp. 108–116. Algiers, 1931.

A brief account is given of the history of malaria and its control in Greece. *Anopheles maculipennis*, Mg., is the most important vector; *A. superpictus*, Grassi, *A. bifurcatus*, L., and *A. hyrcanus* var. *pseudopictus*, Grassi, being less common, are of secondary importance. Recently *A. sacharovi*, Favr (*elutus*, Edw.) has been observed in certain localities in Macedonia and *A. italicus*, Raff., in Epirus. The present organisation for the control of malaria is described.

HUSSAMEDDIN (—). **La lutte contre le paludisme en Turquie.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, ii, pp. 359–401, 1 map. Algiers, 1931.

The anti-malaria campaign begun in three areas of the Turkish Republic in 1925 was extended during the next five years until in 1929 it covered the greater part of the malarious regions. The substance of the laws and regulations dealing with its administration is given. The organisation of anti-malaria measures in areas within and without the eleven zones covered by the campaign is described. Notes are given on the methods of blood and spleen examination and the administration of quinine, and the present situation in each of the zones is briefly summarised.

The abolition of small breeding-places of Anophelines in or near villages or on private properties is undertaken by the villagers or the land-owners; the treatment of swamps is undertaken by conscripted labour, and that of still larger swamps, rivers, large streams and lakes is carried out by the government. In swamps where drainage requires time, crude oil is employed. Paris green has also been used with success [*cf. R.A.E.*, B, xix, 181]. A motor-pump has given satisfactory results in the removal of deep collections of water. The destruction during the winter of adult mosquitos sheltering in houses and stables is undertaken by means of various insecticides, and in one locality trains traversing malarious regions are sprayed on arrival. A list is given of the mosquitos recorded from Turkey, showing the localities where they have been taken; the Anophelines have already been noticed [*loc. cit.*]. The results obtained in localities where the campaign is in force are very satisfactory, and it will continue to be extended until it includes all malarious areas.

SWELLENGREBEL (N. H.). **Report on Investigation into Malaria in the Union of South Africa, 1930–1931.**—*Ann. Rep. Dept. Publ. Hlth. S. Afr. 1930–31*, Annexure 41 pp. Pretoria, 1931.

A comprehensive account is given of the present malaria situation in the Union of South Africa, particularly in the Transvaal and in the sugar belt of Natal, and practical measures are recommended for its control, including details of the organisations necessary for their application.

The recommendation of anti-larval measures is based on investigations of the malaria vectors [*R.A.E.*, B, xix, 246], which indicated that the breeding habits of *Anopheles gambiae*, Giles (*costalis*, Theo.) and *A. funestus*, Giles, are sufficiently definite to allow of species sanitation. In these circumstances, it appears unnecessary to carry out extensive and costly drainage or oiling schemes for marshes, which may almost always be ignored. The author points out, however, that further research is needed to confirm the habits of these mosquitos, and to determine whether a ubiquitous breeder such as *A. pretoriensis*, Theo., may not also be an important vector [*cf.* xix, 247].

Malaria in areas where *A. gambiae* is the vector is dependent on local rains, so that in years when long gaps of drought occur there will be little or no fever. The breeding of *A. funestus* is not, however, related to rainfall, and in areas where this species is the sole vector the malaria incidence may be high in years of low rainfall. For this reason also, these areas are more likely to be affected by malaria every year and to constitute endemic foci [*cf. loc. cit.*]. Epidemics, being dependent on the breeding of *A. gambiae*, are closely associated with years of heavy rainfall, especially when these are followed by a period of hot weather, provided that the rain continues with intervals not exceeding 7 days. The view that epidemics in the south are due to the importation by train of mosquitos from the endemic areas further north is erroneous; *A. gambiae* is present in epidemic areas at all times, and the epidemics are caused mainly, if not entirely, by an unusual extension of its breeding-places caused by local rains. The author points out that it is useless to treat water in tanks, tins, pots, roof-gutters, tree holes, swamps and marshes, which are usually supposed to need attention, partly owing to the erroneous application of experience gained in other countries under entirely different conditions. In the case of marshes and swamps attempts at drainage may render the area suitable for the breeding of *A. gambiae* by allowing the formation of pools in the drainage channels. Breeding may also be established in shallow swamps by allowing cattle to trample down the reeds. Vegetation should not be cut down, as its presence, with the resulting shade, may be the only factor that prevents the breeding of *A. gambiae*, except on the edges of the hill streams, where its removal may reduce the breeding of *A. funestus*.

A study of the relation of altitude to malaria incidence showed that in the flat country with only a few fairly large streams, malaria is carried almost exclusively by *A. gambiae*; whereas in the foothills, small streams become more abundant, dry gulleys holding standing rainwater disappear, puddles dry quickly and malaria is almost always transmitted by *A. funestus*. At an altitude of about 3,000 ft., although the streams are still present, *A. funestus* disappears, probably owing to the lower temperatures that prevail at this height [*cf. loc. cit.*], and malaria is much less prevalent. Lower temperatures do not apparently affect *A. gambiae*, and altitude is not a safeguard against malaria in places, such as plateaux, where this species can become established. Problems relating to settlement and to management of labour in relation to malaria are discussed. Screening and the capture of mosquitos in houses are recommended.

SYMES (C. B.). **Observations on Anophelines and Malaria in Kitale, with Notes on experimental Control with Paris Green.**—*Kenya & E. Afr. Med. J.*, viii, nos. 9–10, pp. 256–267, 280–283, 2 refs. Nairobi, December 1931–January 1932.

A brief report is given of the results of an Anopheline survey, carried out periodically during 1929 in Kitale, Kenya Colony. The species found were *Anopheles natalensis*, Hill & Haydon, *A. gambiae*, Giles (*costalis*, Theo.), *A. christyi*, Newst. & Cart., *A. funestus*, Giles, *A. implexus*, Theo., *A. mauritianus*, Grp., *A. squamosus*, Theo., *A. pretoriensis*, Theo., *A. rhodesiensis*, Theo., and *A. transvaalensis*, Cart. *A. gambiae* and *A. funestus* appear to be the important malaria-carrying species, being naturally infective and readily attracted to man. Their seasonal incidence also appears to coincide with that of malaria. Other species are not found, except to a very limited extent, in human habitations and are considered to be of secondary importance. It is suggested that further investigations may prove that *A. funestus* is essentially the vector of residual malaria and particularly of the quartan type, whereas *A. gambiae* is mainly responsible for the wet season rise of malignant tertian.

Notes are given on the breeding-places of the various species. There appears to be a steady output of *A. funestus* in small jungle streams during the drier months. Heavy rains during the period April–June tend to deprive this Anopheline of its shelter in streams, but provide temporary surface breeding grounds in the grassy swamp areas, involving an actual increase in output. The same rains provide open surface water for the sudden heavy increase of *A. gambiae*, which otherwise finds precarious breeding-places along the stagnant edges of streams and swamps.

Dusting with Paris green was experimentally substituted for oiling in 1929 in the township of Kitale and its immediate surroundings, comprising an area of about 15 sq. miles. It was possible to treat with Paris green long stretches of jungle-covered streams that could not be effectively treated with oil, although the Anopheline season coincided with the wet season and the heavy rains were likely to interfere considerably with the efficacy of the larvicide. Tabulated results of larval collections show that, although promising, the experiment did not secure satisfactory control of Anophelines, although a definite decrease in malaria incidence occurred in 1930 which may have been due to the control measures. Details of the experiment, together with the amount and cost of material and equipment used, are given. Further investigation of the use of Paris green in this and other districts are considered necessary before it can be definitely advocated for general adoption as a substitute for oil.

HENDERSON (L. H.). **Some Observations on the Incidence of Malaria amongst the Nilotic Tribes.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxv., no. 4, pp. 281–286. London, 30th January 1932.

The incidence of malaria among the tribes inhabiting the Upper Nile Province of the Sudan is described. *Anopheles funestus*, Giles, *A. gambiae*, Giles, and *A. pharoensis*, Theo., are probably the chief vectors. *A. funestus*, which is apparently the most important, is active only during the rains (May–October) in the northern and central parts of the Province, but in southern parts it persists throughout the year. In darkened rooms it bites freely during the day, but in the open it has been observed to bite only for an hour or so after sunset and before sunrise. *A. gambiae* appears in all parts of the Province immediately after the beginning of the rains, but it rapidly disappears in the dry weather, even in places where ideal breeding-places persist. It is found most commonly near native villages. *A. pharoensis* occurs chiefly in the central parts of the Province and, like *A. gambiae*, practically disappears during the dry weather. *A. squamosus*, Theo., *A. mauritianus*, Grp., and *A. rhodesiensis*, Theo., have been found in small numbers in various parts of the Province near human habitations. *A. nili*, Theo., and *A. wellcomei*, Theo., are the chief Anophelines found in areas remote from villages.

HARRIS (F.). **The Military Malaria Problem in Hong Kong.**—*J. R.A.M.C.*, lviii, nos. 1–2, pp. 5–23, 92–102, 6 figs., 2 maps, 4 refs. London, January-February 1932.

An account is given of the history of malaria in the Crown Colony of Hong Kong and of the general situation at the present time, particularly from the military point of view. Malaria does not occur in the cities of Victoria and Kowloon, but is active and widespread among the rural Chinese population, although it is manifested in a comparatively mild form, and is present in certain European suburban districts. From a climatic and topographic point of view, the Colony is singularly favourable for the development of mosquitos and the propagation of malaria. Larval development occurs throughout the year, and the adults bite freely but are most active from August to September. Malaria is also prevalent in all months, but reaches its maximum incidence in September, October and November. Six species of *Anopheles* have been found, *A. maculatus*, Theo., *A. minimus*, Theo., *A. karwari*, James, *A. jeyporiensis*, James, *A. aitkeni*, James, and *A. hyrcanus*, Pall., of which the first two are the principal vectors of malaria. Brief notes are given on the incidence and breeding-places of these mosquitos. The most important reservoir of infection is the native Chinese population. Malaria among troops may be controlled by suitable measures, such as oiling, drainage, etc., which are discussed, and by deferring camps until the middle of November.

de Souza Pinto (G.). **Sobre a presença de** *Anopheles costalis* **no Brazil.** [On the presence of *A. gambiae* in Brazil.]—*A Folha medica*, xii, no. 28, pp. 330–332. Rio de Janeiro, 5th October 1931.

In March 1930, *Anopheles gambiae*, Giles (*costalis*, Theo.) was discovered at Natal, in the Brazilian province of Rio Grande do Norte [*R.A.E.*, B, xviii, 150]. Larvae were taken near the anchorage of the fast boats of the Dakar-Natal service, and subsequently adults were found in dwellings and showed an extraordinarily high rate of malaria infection [xix, 188]. It is suggested that this mosquito was imported in the adult stage in the cross-Atlantic steamers. It has recently been found at distances up to 120 miles from Natal. Malaria, due exclusively to *Plasmodium vivax*, has spread, with a very high mortality, to many localities in Rio Grande do Norte. At Taipu there were 6,000 cases, representing two-thirds of the population.

Diaz Florez (A.) & Gil Collado (J.). **Sobre la biologia de la** *Myzomyia hispaniola* **en Alcolea.** [On the Biology of *Anopheles hispaniola* in Alcolea.]—*Med. Países calidos*, v, no. 1, pp. 7–20, 3 graphs. Madrid, 31st January 1932. (With a Summary in English.)

In Alcolea, in the province of Cordoba, Spain, the larvae of *Anopheles* (*Myzomyia*) *hispaniola*, Theo., occur only from August to December, during which period there appear to be 3–4 generations. The hibernating females seem much less domestic than the adults of the other generations, which are always less so than *A. maculipennis*, Mg. The absence of larvae during the early months of the year is perhaps due to the unfavourable condition of rivers at that period.

Torres Cañamares (F.). **Nota sobre los** *Phlebotomus* **y Anofelinos de algunos lugares de la provincia de Cáceres.** [A Note on the Species of *Phlebotomus* and Anophelines in some Localities in the Province of Cáceres.]—*Med. Países calidos*, v, no. 1, pp. 28–32. Madrid, 31st January 1932. (With a Summary in French.)

New local records are given for the province of Cáceres, Spain, for *Phlebotomus parroti*, Adl. & Thdr., *P. sergenti*, Parr., *P. perniciosus*, Newst., and *P. papatasii*, Scop., and for *Anopheles maculipennis*, Mg., which is very abundant, and *A. bifurcatus*, L., one male of which was taken. *P. parroti* does not appear to be a domestic species and was never found engorged with blood. On the other hand, *P. papatasii*, *P. sergenti* and *P. perniciosus* were never found in the field, and nearly all the females, especially those of the first two, were engorged.

Gil Collado (J.). **La invernación del** *Anopheles maculipennis* **en jaulas experimentales.** [The Hibernation of *A. maculipennis* in experimental cages.]—*Med. Países calidos*, v, no. 1, pp. 1–6. Madrid, 31st January 1932.

Observations in Spain on the hibernation of *Anopheles maculipennis*, Mg., were carried out in 1930–31 in a mosquito house consisting of 3 separate cages, each subdivided into 3 compartments, one of wire gauze and the other two of brick and tile. Rabbits were placed in the cages and water surfaces were provided. The male mosquitos disappeared on 3rd November, when true hibernation began. Throughout November the females were hyperactive, flying in full sunlight and endeavouring to escape through the wire gauze. This phenomenon may be connected with pre-winter migration [*cf. R.A.E.*, B, xix, 123]; it was never observed in summer, but occurred again at the end of the winter. Fresh blood was rarely found in these active females. Early in December the temperature began to fall and on the 8th at 6°C. [42·8°F.] the mosquitos were motionless. On the 11th with a rise in temperature to between 6 and 16°C. [42·8 and 60·8°F.] they began to move, and at the highest temperature three flew into the outer cage. None contained fresh blood. During the cold spell they were confined to the inner compartments. This may be due to a physiological need for cold, or perhaps mosquitos that became active owing to the warmth in the rabbit hutches went outside and there became inactive. On 7th January 1931 one individual containing fresh blood was found. On 10th February several dead mosquitos were seen on the water, the coldness of which had probably killed them. There were no eggs, and only some of the mosquitos had fully matured ovaries, so that oviposition was not the reason for seeking the water. Early in March, the temperature being high, the mosquitos became hyperactive and sought to escape through the gauze. On 29th March the first eggs were seen. A very severe mortality at this time is ascribed to latent injuries caused by the cold becoming operative in the warm weather.

GALLI-VALERIO (B.). **Observations sur les Culicidés, les Tabanidés et les Simulidés.**—*Zbl. Bakt.* (1. Orig.), cxxiii, no. 7–8, pp. 485–490. Jena, 3rd February 1932.

Records are given of the occurrence in Switzerland of *Anopheles maculipennis*, Mg., *A. bifurcatus*, L., and other mosquitos at various dates and temperatures. The preferred breeding-places of these two Anophelines contained green algae. *Gasterosteus aculeatus* was found to feed actively on mosquito larvae and pupae, but it would be inadvisable to introduce it in lakes and rivers owing to the danger to other fish.

Tabanids were very common in 1930 and 1931, and their distribution did not coincide with that of cattle. In June 1931 the author was attacked so severely by swarms of *Tabanus* and *Chrysops* at an altitude of about 6,000 ft. as almost to cause his death. Tabanids rendered haymaking impossible in some localities, and cattle had to be pastured by night. Cattle afford no protection to man against these pests.

Simulium gallii, Edw., was not so abundant as in 1928 and 1929. The author has not previously found this fly to attack man, but was personally attacked by several individuals in May 1931.

ACHUNDOW (J.). **Zur Frage der Biologie und das Vorkommen von *Stegomyia fasciata* in Baku (Aserbeidschan, U.S.S.R.).** [The Biology and Occurrence of *Aëdes argenteus* in Baku, Azerbaijan.]—*Arch. Schiffs- u. Tropenhyg.*, xxxvi, no. 1, pp. 31–33, 8 refs. Leipzig, January 1932.

Aëdes argenteus, Poir. (*Stegomyia fasciata*, F.) is fairly abundant at Baku, breeding in wooden wash-tubs and similar receptacles in houses. In the laboratory in water of a temperature of 25°C. [77°F.], the total duration of the life-cycle was 9–10 days.

Dyer (R. E.), Ceder (E. T.), Workman (W. G.), Rumreich (A.) & Badger (L. F.). **Transmission of Endemic Typhus by rubbing either crushed infected Fleas or infected Flea Feces into Wounds.**—*Publ. Hlth. Rep.*, xlvii, no. 3, pp. 131–133, 7 refs. Washington, D.C., 15th February 1932.

Further work on the virus of endemic typhus [Brill's disease] has shown that it may remain virulent in the flea, *Xenopsylla cheopis*, Roths., for as long as 52 days [*cf. R.A.E.*, B, xx, 50]. As a rat infected with endemic typhus presumably remains infective to Arthropods for a relatively short time and the fleas apparently retain their infection throughout their life, the importance of the latter in perpetuating the virus in nature is apparent.

Details are given of experiments showing that infection may be transmitted by rubbing crushed infected fleas and faeces of infected fleas on the abraded abdomen of healthy guineapigs.

Hase (A.). **Ueber die unterschiedliche Widerstandfähigkeit der parasitären Hauswanzen** *Cimex lectularius* **und** *Cimex rotundatus* **gegenüber der Einwirkung von Aethylenoxyd.** [On the Variation in Resistance of the parasitic House-bugs, *C. lectularius* and *C. hemiptera*, to the Influence of Ethylene Oxide.]—*Z. Parasitenk.*, iv, no. 2, pp. 369–386, 2 figs., 7 refs. Berlin, 28th January 1932.

Investigations carried out to test the effect of ethylene oxide, using about 2 oz. to 100 cu. ft. with exposures of 2–4 hours, on *Cimex lectularius*, L., and *C. hemiptera*, F. (*rotundatus*, Sign.) showed that eggs, nymphs and adults of the latter were more susceptible than the corresponding stages of the former, and that the fourth and fifth instars of both were more resistant than the adults. Although some degree of development occurred in some of the eggs of *C. lectularius*, no larvae hatched from the exposed eggs of either species. Immediately after experiments the bugs appeared unaffected. It was not until 24 hours later that the first individuals were seen to be motionless, and many were not fatally affected until 6 days after exposure.

Strickland (C.). **Edible and Paralysific Bugs, one of which a new Species,** *Cyclopelta subhimalayensis* **n. sp. (Hemipteron, Heteropteron, Pentatomida, Dinadorina).**—*Ind. J. Med. Res.*, xix, no. 3, pp. 873–876, 1 pl., 2 refs. Calcutta, January 1932.

Several native tribes in Assam are in the habit of eating certain species of bugs, including the Pentatomids, *Aspongopus nepalensis*, Westw., *A. chinensis*, Dall., and *Cyclopelta subhimalayensis*, sp. n. The stink gland of these bugs is removed by certain tribes as it is thought to cause paralysis, but experiments have shown that it possesses none of the properties attributed to it.

Iyengar (M. O. T.). **Anopheles Breeding in Relation to Season.**—*Ind. J. Med. Res.*, xix, no. 3, pp. 917–939, 12 charts. Calcutta, January 1932.

In a rural area of the 24-Perganas District of Bengal, an examination of the Anopheline fauna in all natural collections of water has been carried out every fortnight since March 1926. A total of 440,000 individuals collected between 1926 and 1930 comprised the following

11 species: *Anopheles aconitus*, Dön., and *A. varuna*, Iyengar, which breed most abundantly from August to November, the former occurring in very small numbers compared with the latter; *A. philippinensis* Ludl., and *A. tessellatus*, Theo., which only occur in small numbers and also breed during the wet season, the former being most abundant in September and the latter ceasing to breed altogether from November to May; *A. culicifacies*, Giles, and *A. fuliginosus*, Giles, which breed during the dry season, the former occurring in greatest numbers from March to July and being practically absent during the rest of the year, and the latter showing a peak in April–May; *A. hyrcanus*, Pall., which breeds in the early winter and has its highest incidence in December and January; *A. vagus*, Dön., which breeds most abundantly during the hot, dry season from April to June; *A. subpictus*, Grassi, which breeds during the early rains in May–July; *A. barbirostris*, Wulp, which has its highest incidence in the late winter, during February and March; and *A. pseudojamesi*, Strick. & Chwd., which breeds during the wet season and reaches its maximum numbers during August–October. The first 7 species are known vectors of malaria, but in only the first 4 cases does the season of maximum incidence coincide with the malaria season, September–November. With regard to the relative prevalence of these species during the season of maximum prevalence, *A. varuna* is undoubtedly the most numerous, rising to above 30 per cent. of the total number of larvae collected, *A. aconitus* reaches about 4 per cent., and *A. philippinensis* and *A. tessellatus* 1 per cent. and under.

RAO (S. SUNDAR) & IYENGAR (M. O. T.). **The Escape of the Filaria Larva from the Proboscis of** *Culex fatigans*.—*Ind. J. Med. Res.*, xix, no. 3, pp. 941–944, 1 pl., 6 refs. Calcutta, January 1932.

In order to study the process of penetration of the skin by mature larvae of *Filaria bancrofti*, experimentally infected females of *Culex fatigans*, Wied., were fed on man, and after a short time were removed to determine whether the larvae had emerged. The mosquitos were stunned by a shake and placed under a cover slip under the microscope. In one case a filarial larva was seen to emerge from the extreme tip of the right labella, thus confirming, under natural conditions, the observations made by Yamada and Komori [*R.A.E.*, B, xvi, 67] on material in which the bursting of the tip of the labella was facilitated by mechanical pressure.

[PAVLOVSKIĬ (E. N.).] **Павловский (Е. Н.). The Ground-squirrels in Epidemiology and Parasitology.** [*In Russian.*]—*Bull. Plant Prot.*, iv, no. 1, pp. 73–84. Leningrad, 1931. (With a Summary in English.)

This is a survey of the literature on the importance of ground squirrels (*Citellus*) and their parasites in relation to disease. The bulk of the paper deals with the part they play in the spread of plague to man in the Russian Union. Infection is acquired either by immediate contact with infected dead animals or by means of their fleas, which pass to other rodents and readily bite man. Tables showing which of the species of fleas harboured by various rodents attack man and which are capable of transmitting plague are reproduced from a paper by Golov and Ioff [*R.A.E.*, B, xvi, 220], and notes are given on the ability of fleas to preserve virulent plague bacilli for considerable periods of time and on the possibility of the transmission of the disease by the tick, *Rhipicephalus schulzei*, Olenev, which has been found on ground squirrels in Kazakstan [xviii, 270]. Reference is also made to the relation of ground squirrels and their ectoparasites to tularaemia and Rocky Mountain spotted fever in the United States, their possible association in Central Asia with relapsing fever, the vector of which is *Ornithodorus papillipes*, Bir., and their importance as hosts of various ticks that attack cattle. Instructions for the collection and preservation of ectoparasites are appended.

OTTEN (L.). **Het probleem van de " seasonal prevalence " der pest.** [The Problem of Seasonal Prevalence of Plague.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 1, pp. 28–37. Batavia, 1st January 1932.

Java has a fairly equable temperature throughout the year. During the rainy season (November–April), the temperature is cooler and relative humidity is higher than in the dry season (May–October), but even in the warmest months (October–November), the average daily temperature is below 85°F., while the relative humidity is always over 60 per cent. even in the driest months (August–September). There is a certain periodic fluctuation in the incidence of plague in Java that cannot be regarded as seasonal in the ordinary sense, for the increase begins at the time of greatest warmth and dryness, and the decrease occurs in the middle of the rainy season. It was found, however, that the flea-index of *Xenopsylla cheopis*, Roths., on house rats corresponded, at least in the hilly district, rising as the relative humidity falls and *vice versa*.

DURIEUX (C.). **Cas de fièvre récurrente observés à Dakar et dans ses environs.—Découverte de l'ornithodore agent de transmission de l'infection.**—*Bull. Soc. Path. exot.*, xxv, no. 1, pp. 13–18. Paris, 1932.

Examination of rat burrows under dwellings in and near Dakar in which cases of relapsing fever had occurred revealed the presence of individuals of *Ornithodorus erraticus*, Lucas (*marocanus*, Vélu), which were subsequently proved by experiment to be naturally infected with spirochaetes, apparently *Spirochaeta duttoni* var. *crocidurae* [*cf. R.A.E.*, B, xvi, 265].

DENNIS (E. W.). **The Life-cycle of** *Babesia bigemina* **(Smith & Kilbourne) of Texas Cattle-fever in the Tick** *Margaropus annulatus* **(Say) with Notes on the Embryology of** *Margaropus*.—*Univ. Cal. Pub. Zool.*, xxxvi, no. 11, pp. 263–298, 6 pls., 1 fig., 40 refs. Berkeley, Cal., 1932.

The life-history and anatomy of *Boophilus* (*Margaropus*) *annulatus*, Say, are reviewed, and its embryology is described. An account is given of the life-cycle of *Piroplasma bigeminum* in this tick, which demonstrates its suitability to act as the vector. *P. bigeminum* is confined to the blood of the bovine host, which is the sole food of the tick. The feeding period of *B. annulatus* is all passed on one animal, so that the opportunities for ingestion of the parasites are great, even if the vertebrate host is only a " carrier " and the parasites scarce in the peripheral blood. The gut of the tick is blind, so that any parasites ingested and not destroyed by the digestive ferments are retained in the gut and tend to accumulate, thus increasing the opportunities for the gametes to become associated. Owing to the close contact between the digestive tract and reproductive organs of the tick, any parasites leaving the gut will invade the latter and occupy the ova. Within the egg certain stages of the parasite migrate throughout the tissues of the developing tick, and, since much of the embryonic cell mass contributes to the formation of the salivary glands, it is almost inevitable that some of the parasites should occur in these structures and be transferred to a new vertebrate host during the feeding process of the larval tick.

The life-cycle of *P. bigeminum* has two distinct phases, *viz.*, an asexual cycle in the vertebrate host where multiplication takes place in the red blood corpuscles by binary fission, and a simple sexual cycle in the tick.

The author considers that the correct generic name for this protozoon is *Babesia.*

NICOLLE (C.) & ANDERSON (C.). **Sensibilité du porc aux souches africaines de** *Spirochaeta hispanicum.*—*C. R. Acad. Sci. Fr.*, cxciv, no. 4, pp. 333–335, 3 refs. Paris, 1932.

Investigations showed that though a pig infected with *Spirochaeta hispanica* var. *marocana*, which is carried by *Ornithodorus erraticus*, Lucas, in Morocco, exhibits no symptoms of the disease, its blood is infective to guineapigs.

ROBERTS (F. H. S.). **The Cattle-poisoning Sawfly** (*Pterygophorus analis* **Costa**).—*Queensland Agric. J.*, xxxvii, pt. 1, pp. 41–52, 2 pls., 5 refs. Brisbane, 1st January 1932.

Much of this information on *Pterygophorus analis*, Costa, in Queensland, has already been noticed [*R.A.E.*, B, ix, 215]. The fatal disease in cattle that results from their eating the larvae is associated with the occurrence of the latter far in excess of the available food supply, when most of them are killed by starvation, probably aided by high temperature and sunlight. It is suggested that this disease is caused by an organism similar to that responsible for lamsiekte in South Africa [*cf.* xv, 129], and follows the ingestion of rotting material only, live larvae alone producing no ill effects. Experiments indicate that the larvae are eaten by the cattle because their diet is deficient in phosphorous. This theory is supported by the successful use of phosphate cattle-licks in one locality during a serious outbreak in 1931.

PAPERS NOTICED BY TITLE ONLY.

TRENSZ (F.). **L'index maxillaire d'***Anopheles maculipennis* **et la théorie du zootropisme anophélien.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 155–224, 2 pls., 45 graphs, 75 refs. Algiers, 1931. [See *R.A.E.*, B, xix, 106.]

KLIGLER (I. J.) & MER (G.). **Studies on Malaria : VI. Long-range Dispersion of** *Anopheles* [*sacharovi*, Favr, in Palestine] **during the prehibernating Period.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 242–255, 2 charts, 4 figs., 5 refs. Algiers, 1931. [See *R.A.E.*, B, xix, 123.]

DE BUEN (S.) & DE BUEN (E.). **Notes sur la biologie de l'***A*[*nopheles*] *maculipennis* [in Spain].—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 277–288, 9 pls., 2 figs. Algiers, 1931. [Translation of *R.A.E.*, B, xix, 3.]

DE BUCK (A.), SCHOUTE (E.) & SWELLENGREBEL (N. H.). **Nouvelles recherches sur les races d'***Anopheles maculipennis* **aux Pays-Bas.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 293–300. Algiers, 1931. [*Cf. R.A.E.*, B, xviii, 228.]

VAN THIEL (P. H.). *Anopheles maculipennis* **et la variété** *atroparvus ;* **un problème de l'anophélisme sans paludisme.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 302–304. Algiers, 1931. [See *R.A.E.*, B, xix, 189.]

TALICE (R. V.). **L'Uruguay, pays d'anophélisme sans paludisme.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 305–307. Algiers, 1931. [*Cf. R.A.E.*, B, xvii, 51.]

D'ENGEL (R.). **Observations sur l'endémie alternative de paludisme aux environs de la ville de Kolozsvar, pendant une période de cinquante ans.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 311–321, 1 graph. Algiers, 1931. [See *R.A.E.*, B, xix, 142.]

HACKETT (L. W.) & MISSIROLI (A.). **Field Studies on the Causes of the Natural Disappearance of Malaria in certain Regions of Europe.**—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 322–346, 11 refs. Algiers, 1931. [See *R.A.E.*, B, xix, 107.]

MISSIROLI (A.). **Le grandi bonifiche nei riguardi della biologia e dell'igiene.** [Large-scale Reclamation Work in Relation to Biology and Hygiene.]—*C. R. 2e Cong. int. Paludisme Alger 1930*, i, pp. 348–403, 4 pls., 8 figs., 2 maps, 1 graph, 62 refs. Algiers, 1931. [See *R.A.E.*, B, xix, 68.]

PURI (I. M.). **Studies on Indian Simuliidae. Part I.** *Simulium himalayense* **sp. n. ;** *Simulium gurneyae* **Senior-White ; and** *Similium nilgiricum* **sp. n.**—*Ind. J. Med. Res.*, xix, no. 3, pp. 883–898, 1 pl., 3 figs., 7 refs. Calcutta, January 1932.

PURI (I. M.). **Studies on Indian Simuliidae. Part II. Descriptions of Males, Females and Pupae of** *Silimium rufibasis* **Brunetti, its Variety** *fasciatum*, **nov. var., and of three new Species** [*S. ramosum*, *S. christophersi* and *S. nitidithorax*] **from the Himalayas.**—*Ind. J. Med. Res.*, xix, no. 3, pp. 899–915, 2 pls., 4 refs. Calcutta, January 1932.

CLARK (A. McK.). **Eradication of Lice and Tick** [*Melophagus ovinus*, L.] **in Sheep.**—*J. Dept. Agric. W. Aust.*, (2) viii, no. 4, pp. 477–478. McCALLUM (H.). **The Sheep Louse.**—*T.c.*, pp. 478–481, 1 diag. NEWMAN (L. J.). **External Parasites of Sheep.**—*T.c.*, pp. 482–490, 11 figs. Perth, W. A., December 1931. [See *R.A.E.*, B, xiii, 102, 103.]

JANCKE (O.). **Mitteilungen über Anopluren.** [*Neohaematopinus sciuri*, sp. n., described from the Squirrel in Germany.]—*Z. Parasitenk.*, iv, no. 2, pp. 240–253, 20 figs., 9 refs. Berlin, 28th January 1932.

MUSGRAVE (A.). **Some Australian Ticks.**—*Aust. Mus. Mag.*, iv, no. 9, pp. 316–323, 8 figs., 4 refs. Sydney, 1932.

This paper is a compilation of notes on a few of the 40 species of ticks recorded from Australia, including *Argas persicus*, Oken (fowl tick), *Ixodes holocyclus*, Neum., which cause paralysis in man and dogs, *Boophilus annulatus australis*, Fuller, which attacks cattle, and *Amblyomma triguttatum*, Koch, which attacks cattle, dogs, horses, platypus and kangaroo.

TOOP (C. R.). **Buffalo Fly.**—*J. Dept. Agric. W. Aust.*, (2) viii, no. 4, pp. 453–462, 3 figs. Perth, W. A., December 1931.

In view of the danger of the introduction of *Lyperosia exigua*, de Meij. (buffalo fly) into the southern part of Western Australia on cattle transported by sea from the north of the State [*cf. R.A.E.*, B, xviii, 117], a number of sprays were tested for treating cattle prior to their being embarked for shipment. By ridding the cattle of the flies such treatment would preclude the possibility of the manure, in which they breed and which is of considerable commercial value, from becoming infested while the cattle are in transit. In devising a mechanical means of applying the insecticide, which should preferably be repellent as well as toxic to the flies, it has to be borne in mind that the cattle are shipped in consignments of from 320 to 760 individuals, and that owing to the tides the maximum time for loading should not exceed six hours. Of the insecticides tested, two proprietary " fly-sprays " used undiluted were immediately toxic to the flies, but their cost renders their use prohibitive. Some of the other materials had a disabling effect, and were lethal on contact, but none of them were possessed of more than transient repellent qualities, so that they are only of value if the cattle are immediately removed from any danger of reinfestation. The one selected for practical use is a proprietary oil, which is diluted with 60 parts water. At the chief port of embarkation the cattle are treated in a race extending from the stock yard to the ship's side, about 990 ft. long. One overhead and two lateral pipes, each 120 ft. long with jets at intervals of 3 ft., are used for spraying, and each animal thus receives about 2½ gals. of a dense spray. For small scale work at another port a hand spray is used. When infestation is high, the efficiency of such treatment appears to exceed 99 per cent., and with a smaller infestation, no flies survive.

MARLATT (C. L.). **Report** [1930–31] **of the Chief of the Bureau of Entomology.**—87 pp. Washington, D.C., U.S. Dept. Agric., 1931. [Recd. February 1932.]

F. C. Bishopp contributes a report (pp. 71–76) on work carried out under his direction in connection with insects affecting man and animals in the United States during the year 1930–31.

In the course of experiments on the use of traps over large areas for the control of blow-flies [*Cochliomyia macellaria*, F., and *Phormia regina*, Mg.] [*cf. R.A.E.*, B, xix, 94], a portable trap has been designed sufficiently large to take medium-sized carcases, 28 U.S. gals. of flies being captured in one of these traps in 6 weeks. The abundance of the larval parasite, *Brachymeria fonscolombei*, Dufour, in Texas, where releases were made in the previous year [xix, 251], was somewhat less, the average parasitism being about 30 per cent., whereas in the previous year it was more than 39 per cent. The percentage of parasitism by the pupal parasite, *Mormoniella vitripennis*, Wlk., however, increased from 1·25 to 1·42.

Investigations in Alaska of the reindeer botflies, *Oedemagena tarandi*, L., and *Cephenomyia trompe*, Modeer, which are extremely difficult to control owing to the methods of handling the reindeer on the range, include an experiment to decide the feasibility of reducing these pests by pasture rotation. The dense coats of the reindeer make it very difficult to bring insecticides in contact with the skin, and special nozzles and methods of application are being developed.

A severe outbreak of *Simulium* (*Eusimulium*) *pecuarum*, Riley, occurred in parts of Mississippi and Arkansas in the spring of 1931 in the absence of flooding, which has usually been associated with such outbreaks. Apparently the extremely low level of the streams in the preceding year induced the growth of vegetation along their beds, and the return of normal water levels created places of attachment and development for the larvae.

MALKANI (P. G.). **Discovery of the oesophageal Stage Larvae of** *Hypoderma lineatum*, **Villiers in Indian Cattle.**—*Ind. Vet. J.*, viii, no. 3, pp. 178–193, 1 pl., 42 refs. Madras, January 1932.

A detailed account is given of investigations on the larvae of *Hypoderma lineatum*, Vill., found in Indian cattle [*R.A.E.*, B, xix, 112]. The larvae were first discovered in September 1929 in the course of a *post mortem* examination, when they were found deeply embedded in the submucosa of the gullet. Subsequently they were observed in the loose connective tissue outside the oesophagus, in that overlying the rumen, the spleen and the ribs and once on the peritoneal surface near the oesophagus. Larvae were also found in the subcutaneous tissues, but none was discovered in the spinal canal or on the interior of the rumen. Numerous larvae were found in the gullet and over the rumen up to 17th December, after which date they no longer occurred there, but began to appear in the skin. After 20th April 1930, however, smaller larvae, evidently a new generation, were again detected both inside and outside the gullet and over the rumen. It would thus appear that larvae reach the gullet and the rumen at the same time.

The reasons for determining the larvae as those of *H. lineatum* are discussed. Attempts were made to rear the fly by placing larvae in pockets made in the skin of living animals and by breeding them from larvae emerging naturally from animals showing warbles and from larvae squeezed out of warbles, but only one living adult (a male of *H. lineatum*) was obtained, and in this case the possibility of a previously existing natural infection was not excluded.

DINULESCU (G.). **Larves d'oestrides produisant des tumeurs duodénales chez les chevaux en Espagne.**—*Ann. Paras. hum. comp.*, ix, no. 6, pp. 503–511, 2 pls., 6 figs., 10 refs. Paris, 1st November 1931.

A further account is given of the Oestrid larvae very closely resembling *Gastrophilus* (*Oestrus*) *meridionalis*, Pill. & Evans, found in Vaugirard in horses from Spain [*R.A.E.*, B, xix, 258]. Observations showed that after passing the 1st stage in the buccal and pharyngeal mucous membranes, the larvae migrate in the 2nd stage to the mucous membrane of the duodenum, where they endeavour to bury themselves in the wall, causing local reactions in the tissues and the consequent formation of large fibrous tumours. After moulting, the larvae leave the tumour and make their way into the intestinal cavity, where they again attach themselves to the walls, usually embedding their heads and first two segments in the walls and causing very deep alveolar lesions. Descriptions are given of the 2nd and 3rd stage larvae, together with the characters distinguishing the larvae of both stages from those of *G. nasalis*, L., with which they were usually associated.

dos Santos (R.). **Localisation rare de l'*Hypoderma bovis* chez l'homme.**—*Ann. Paras. hum. comp.*, ix, no. 6, pp. 512–513, 2 figs. Paris, 1st November 1932.

A case is recorded from Brazil of infestation by two larvae of *Hypoderma bovis*, DeG., of the penis of a man in the habit of resting and sometimes of sleeping naked in the grass at the side of a stream.

Galliard (H.). **Culicides du Gabon. II. Culicinés (suite). Remarques sur la biologie des *Mansonioides* et d'*Aëdes* (*Stegomyia*) *argenteus* Poiret.**—*Ann. Paras. hum. comp.*, ix, no. 6, pp. 514–529, 9 figs., refs. Paris, 1st November 1931.

Further notes are given on the mosquitos of Gabun, French Equatorial Africa [*cf. R.A.E*, B, xix, 183], and one new variety is described. In the large settlements on the coast, such as Port Gentil, larvae of *Aëdes argenteus*, Poir., may be found during the rains in the usual breeding-places, and adults, which are numerous in houses, bite during the day and night. In the dry season, they are less numerous in houses. In the villages, however, there are few domestic breeding-places, water being fetched when required from neighbouring streams. In the dry season, particularly in villages in the savannah, larvae and pupae may, however, be found in the bowls containing drinking water for pigeons that are kept in every village. Breeding is retarded during the dry season, the rate being influenced by a decrease in temperature rather than by dryness, for the atmospheric humidity remains high. In the forest, suitable breeding-places seldom occur, but larvae have been found in the water that accumulates at the base of kapok trees in artificial clearings. It is reported that the flowers of *Colocasia esculenta* (which is largely grown by the natives for food) secrete a viscous substance that attracts and traps the mosquitos. In certain cases infested villages are said to have been cleared in this manner.

Coulon (G.) & Sautet (J.). ***Gambusia holbrooki* et paludisme en Corse. Résultats de six années de lutte antilarvaire au moyen des poissons culiciphages.**—*Ann. Paras. hum. comp.*, ix, no. 6, pp. 530–545, 8 figs., 9 refs. Paris, 1st November 1931.

An account is given of the results obtained from the distribution and maintenance of the larvicidal fish, *Gambusia holbrooki*, in all important Anopheline breeding-places, which have been carried out as an anti-malaria measure in Corsica during the last six years with beneficial results and comparatively little expenditure. In the coastal regions and low-lying valleys, which are of particular interest from a malarial point of view, conditions are very favourable for the growth and multiplication of this fish, and the climate, with mild winters and warm summers, is very suitable. Moreover, there are no really formidable natural enemies. It can adapt itself to salt waters and tolerates a higher degree of salinity than Anopheline larvae. The best results are obtained in permanent collections of water, such as garden wells, marshes with or without drainage canals, and pools formed by flooding that only communicate with the rivers at times of flood. It is most effective in summer and autumn ; in spring its work should be supplemented by such measures as clearing of vegetation and application of Paris green. In seasonal breeding-places, results are very variable and its action cannot be relied on, although in some cases it is very effective and diminishes the work necessary in an anti-larval campaign. Supplies of fish should be kept to re-stock breeding-places that dry up during the summer, and where possible fish-ponds should be dug at the lowest point of marshes to ensure abundant re-stocking when the waters re-appear.

CAUSEY (O. R.). **Sterilization and Growth of the Eggs and Larvae of the Blow-fly.**—*Amer. J. Hyg.*, xv, no. 1, pp. 276–286, 32 refs. Baltimore, Md., January 1932.

During the War, the late Dr. W. S. Baer noticed that wounds infested with the larvae of certain blow-flies were surgically clean and healed more quickly than those protected from infestation, and, in 1929, he announced the successful treatment of stubborn cases of osteo-myelitis with blow-fly maggots. In view of the possibility that larvae used in such treatments might introduce organisms with which they were not competent to deal, the investigations described in this paper were undertaken to devise a method for obtaining sterile larvae. It was found that an adequate medium for rearing the larvae to a suitable size was constituted by fully-developed rat embryos removed aseptically by Caesarian operation and immediately transferred to nutrient agar (previously melted and cooled to 45°C. [113°F.]), which serves as a check on the sterility of the embryo. Of several compounds tested for sterilising the eggs, a 1 : 1,000 solution of mercury bichloride in 40 per cent. alcohol with the addition of 0·2 per cent. hydrochloric acid was one of the most effective (the exposure being 30 minutes), but the rate of mortality was high. A 1 : 20,000 solution of merthiolate (a sodium salt of ethylmercurithiosalicylic acid) gave a lower mortality and destroyed bacterial spores more quickly, but did not appear to be so effective against cocci. Preliminary experiments with this compound showed that all the spores most frequently encountered in *Calliphora*, *Phormia* and *Lucilia* were killed after an exposure of 20 minutes. After sterilisation, the eggs are rinsed and poured into the culture tubes containing the embryo and agar, the excess water being removed with a pipette. As soon as the eggs hatch, the head of the rat embryo is smashed with a sterile rod so that the larvae may have access to the brain. It was found that apparently normal adults can be reared from sterile larvae.

DU PLESSIS (C.). **Blow-lamp Control of Poultry Pests.**—*Fmg. S. Afr.*, 1932, reprint no. 1, 3 pp., 1 fig. Pretoria, January 1932.

A description is given of a new type of blow-lamp that kills very effectively such pests as *Dermanyssus gallinae*, DeG., and *Argas persicus*, Oken, infesting poultry pens. A chamber having a capacity of 3 gals. paraffin and able to stand a pressure of at least 75 lb. is fitted to the burner, a motor tube valve is put into the tank and pressure is generated by a motor-car pump, a pressure gauge being fitted to the container. To enable the container to be left outside while burning is being done inside the pens and to obviate frequent shifting, it is connected with a 12 ft. length of high pressure rubber hose to a 4 ft. piece of iron tubing terminating in the coil and projector. A large portion of the flame in the projector is brought into the coil so as to keep it at red heat, thus effectively vapourising the paraffin and also igniting the vapour. This blow-lamp throws an 18–24 inch flame of great heat in front of the coil and is most effective for burning out poultry houses. The jet must be at least 5–6 inches away from the back of the coil, which is protected from the outside from rapid cooling by a sheet of tin or zinc securely fastened round it. The 4 ft. piece of iron tubing serves as a handle, and a number of pieces of wire, about 4 inches in length, inserted into each end of this iron tube and tightly packed into each side of the lumen, will break up the stream of paraffin coming from the pressure container into fine streams, which are more easily vaporised than is a solid stream of liquid. It was observed that the flame penetrated into the tiniest cracks, and the heat is intense. Unpainted or untarred woodwork cannot, of course, be treated with this blow-lamp. A row of pens 120 yds. long by 6 ft. wide by 6 ft. high can be treated with one lamp in about 3 hours with about 4 gals. paraffin. It compares favourably with any known method from the point of view of cost, time taken and effectiveness.

HANSON (K. B.). **Parasites of Ranch Foxes and their Treatment.**—*J. Amer. Vet. Med. Ass.*, lxxx, no. 2, pp. 202–209, 2 refs. Detroit, Mich., February 1932.

Fox-farming has, of recent years, become an important branch of the livestock industry of the United States, particularly in the north where the climate is conducive to the production of good fur. The common external parasites of ranch foxes are fleas and ear mites, lice and mange being much less prevalent. Fleas are present on all farms, especially during moist, warm weather, the species in most cases being *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt. Dusting with 1 part freshly ground derris root and 2 parts flour, talc or other carrier gives good results. Fresh pyrethrum is also satisfactory, but as a large number of the fleas that drop off the animal are only temporarily stupified, they should be destroyed by burning or by spraying with 3 per cent. cresol, kerosene emulsion, or some other effective insecticide. If the infestation is heavy, treatment should be repeated in about 10 days. At the same time the houses, nest boxes and chutes should be cleaned and sprayed with insecticide and the litter and débris burned, to destroy the immature stages.

Blue foxes from the islands off the coast of Alaska are commonly infested with *Linognathus piliferus*, Burm., although lice are rarely found on red, cross or silver foxes. When the infestation is light and confined to the region of the head and eyes, the local application of 2 per cent. cresol is advised, the treatment being repeated in 16–18 days. If infestation is heavy, dipping in lukewarm 2 per cent. cresol, followed in a minute or two by immersion in lukewarm slightly soapy water, is recommended. A hand should be held over the end of the muzzle to prevent the animal from aspirating any of the liquid. Dipping should only be undertaken on warm days, when animals can be kept in warm quarters until dry ; rubbing down with towels or burlap is advised.

Ear mange, caused by *Otodectes cynotis*, Her., shows a marked tendency to spread, and the majority of the foxes on affected farms are infested. A mixture of 1 part iodoform, 10 parts ether and 25 parts cottonseed oil or liquid petrolatum gives excellent results. Other satisfactory mixtures consist of 1 part naphthol, 3 parts ether and 10 parts cottonseed oil, or 1 part cade oil to 8 parts cottonseed oil. These mixtures should be applied to the entire inner surface of the ears by means of cotton wool. Two treatments should be given at an interval of a week or 10 days, and the houses thoroughly cleaned and disinfected in the meantime.

Mange, which is relatively common among wild foxes, has seldom been observed on ranches, but usually proves serious if introduced. Of the outbreaks studied, five have been due to a species of *Sarcoptes*, and one to a species of *Notoedres* ; only one isolated case caused by *Demodex* has been observed. Unless treated, mange generally spreads over most of the body and eventually results in death. If an outbreak occurs in winter or late autumn, it is usually advisable to destroy all affected animals as soon as possible, as treatment during cold weather usually proves difficult and unsatisfactory. In mild weather the infested animals should be isolated and protected from chills. Clipping is recommended. Immersion in a soluble lime-sulphur dip every 7–14 days until recovery is the preferred treatment. Re-infestation should be prevented by keeping the pens clean and disinfecting them every 2–3 days. Foxes exposed to infestation and those that have recovered should be kept in quarantine for at least two months. Infested premises should be left unoccupied for two months in summer and for longer in the winter ; during this period they should be thoroughly sprayed or flamed with a kerosene torch.

[BEKLEMISHEV (V.), BRYUKHANOVA (A.) & SHIPITZUINA (N.)]. **Беклемишев (В.), Брюханова (А) и Шипицына (Н). Les prémisses de l'epidémiologie et de la prophylaxie du paludisme à Magnitogorsk. (D'après les observations de 1930.)** [*In Russian.*]—Roy. 8vo, 51 pp., 34 refs. Magnitogorsk, Comiss. Santé publ., 1931. (With a Summary in French.) [Recd. March 1932.]

In the town of Magnitogorsk, situated south of the Ural mountains in the valley of the upper Ural, the malaria incidence is high owing to climatic conditions that favour the disease and the proximity of accumulations of stagnant water suitable for the breeding of *Anopheles maculipennis*, Mg., which is the only vector in the district. In view of the importance of this densely populated new industrial centre, where workmen's settlements are to be constructed, investigations were carried out in the summer of 1930 on the seasonal occurrence of the mosquito and the conditions that favour the development of malaria. The topography of the country with special reference to the distribution of water is discussed, and a detailed description is given of the various types of standing water. Larvae of *A. maculipennis* were very abundant in clear water, the bed of which was sandy or clayey, without dead organic remains, and densely covered with amphibious vegetation and aquatic plants such as *Elodea*, whereas only a few occurred if the vegetation was scarce. Though in some waters the bed was covered with an appreciable amount of organic matter, the larvae were present in numbers if submerged aquatic plants were the predominant vegetation, whereas they were practically absent from waters with slimy beds and the prevalence of plants with leaves that floated on the surface, *Glyceria, Typha* and *Scirpus* occurring in the peripheral zone. Grazing cattle, however, usually altered these conditions into more favourable ones for the breeding of the larvae, as the animals destroyed the last-named type of vegetation, which was gradually replaced by amphibious and submerged aquatic plants. The authors classify the aquatic vegetation into five types, according to the degree of its submergence in the water and the breadth of the leaves, and a table shows the prevalence of mosquito larvae in waters with different vegetations. It was found that the number of larvae decreases in the presence of a greater amount of plants that have the leaves above the water floating on the surface.

In Magnitogorsk, the adults of *A. maculipennis* appear about 20th April and enter hibernation about mid-September. The first eggs occurred in the first half of May at an average temperature of over 10°C. [50°F.] in shallow water exposed to the sun, and the larvae on 16th May when the temperature of the water surface was 25°C. [77°F.]. There appear to be four overlapping generations a year. During the day the mosquitos were numerous in cellars, cattle sheds and dwellings with a relative humidity of 65–88 per cent. and a temperature of 15·6–21·2°C. [about 60–70°F.], whereas they were absent from dry well-aired houses and stables. The first females possessing a fat-body were observed at the end of July. About mid-September the only mosquitos present were females with a developed fat-body, which were abundant in cellars, warm sheep folds and cattle sheds with mud-walls, and in basements of inhabited houses.

Benign tertian malaria [*Plasmodium vivax*] is endemic round Magnitogorsk, the malaria incidence in 1930 being 5–6 per cent. and the spleen index 3·4 per cent. on an average ; a few cases of malignant tertian [*P. falciparum*] of local origin have also been observed. As workmen come to the district from all parts of the Russian Union including malarious regions an epidemic is always possible. Prophylactic measures are briefly discussed and include the regular oiling or dusting with Paris green of the Anopheline breeding-places in the valley of the river Ural for a distance of over 3½ miles, from 15th May till 1st September ; the regulation of the bed of the river and filling of all accumulations of standing water in the area adjoining the site in which a new part of the town is to be built ; and the prohibition of new works or houses within 3,300 yards of a particularly favourable breeding-place.

de Buen (F.). **Notas sobre la fauna ictiológica de nuestras aguas dulces.** [Notes on the Fresh-water Fish Fauna in Spain.]—*Notas y Resúmenes Minist. Fom.* [*Spain*], Ser. II, no. 46, 62 pp., 71 figs. Madrid, 20th December 1930. [Recd. February 1932.]

These notes deal briefly with the fish found in channels, rice-fields, and slow-moving streams in Spain in which Anophelines breed. The species discussed include *Gasterosteus aculeatus*, which feeds voraciously on insect larvae but also destroys other fish, and *Gambusia holbrooki*, which has become established since its introduction for the control of Anopheline larvae.

METCALF (C. L.) & FLINT (W. P.). **Fundamentals of Insect Life.**—Demy 8vo, xi + 581 pp., 315 figs. New York, N.Y., & London, McGraw-Hill Pub. Co. Ltd., 1932. Price 30*s*. net.

This textbook, which is noticed more fully elsewhere [*R.A.E.*, A, xx, 254], is based on a previous one [*R.A.E.*, B, xvii, 19]. The chapters dealing with insects, mites and ticks affecting the health of man and animals in the United States have been revised and brought up to date and much new material has been added.

BRIGHENTI (D.). **Revisione sistematica ed ecologica dei Culicini italiani.** [Systematic and ecological Revision of the Italian Culicine Mosquitos.]—*Atti Soc. ital. Mus. civ.*, lxx, no. 3–4, pp. 216–227, 13 refs. Milan, December 1931.

This is a summary of the distribution of Culicine mosquitos in Italy.

IYENGAR (M. O. P.) & IYENGAR (M. O. T.). **On a *Characium* growing on *Anopheles* Larvae.**—*New Phytologist*, xxxi, no. 1, pp. 66–69, 1 pl., 1 fig., 3 refs. London, 15th February 1932.

Near Sonarpur in Lower Bengal, *Characium anophelesi*, sp. n., was found growing on the larvae of *Anopheles vagus*, Dön., *A. subpictus*, Grassi, *A. hyrcanus*, Pall., *A. barbirostris*, Wulp, *A. pseudojamesi*, Str. & Chd., and *A. varuna*, Iyen. The algae occupied practically all parts of the body of the larvae, but only seemed to hamper to some extent their freedom of movement, without otherwise affecting them. By growing on actively moving larvae, the algae secure better aeration than is normally afforded in stagnant water. They did not occur on larvae of *Culex* or mayflies, possibly because they would not obtain so much sunlight as on an Anopheline larva floating horizontally just below the surface of the water. In moulting, the larva sheds all algae with the old skin, but a fresh coating is rapidly formed on it.

KING (W. V.). **The Philippine *Anopheles* of the *rossi-ludlowi* Group.**—*Philipp. J. Sci.*, xlvii, no. 3, pp. 305–342, 4 pls., 6 figs., 20 refs. Manila, 1932.

Five Anophelines of this group occur in the Philippines, and in this paper their principal distinguishing characters are given, together with comparative observations on related species and the conclusions reached with regard to nomenclature.

Two forms that have previously been included under the name *Anopheles ludlowi*, Theo., are shown to be distinct species. As *A. ludlowi* was originally described from individuals taken in an inland habitat [*cf. R.A.E.*, B, xiii, 112], this name is retained for the form that breeds in fresh water associated with streams, and the salt water form that occurs in the Philippines is described as *A. litoralis*, sp. n. Certain characters are given distinguishing these two forms from *A. sundaicus*, Rdnw., which is also regarded as a distinct species, but the number of authentic larvae of *A. sundaicus* available was not sufficient for a detailed comparison. On biological grounds, however, the difference between *A. litoralis* and *A. sundaicus* appears to be marked. *A. litoralis* breeds in large numbers in salt water fishponds along the coast of the bay on either side of Manila, but no serious outbreaks of malaria are reported from these areas. *A. sundaicus*, on the other hand, is considered to be the principal carrier of malaria in Java and other of the Sunda Islands. Moreover, the Philippine form is abundant in water having a salt content as high as sea water or higher and may or may not occur in brackish pools nearby, whereas *A. sundaicus* is reported to thrive best in water containing 1·2–1·8 per cent. of salt and to disappear when the salt content rises above 3 per cent. [*cf.* xiii, 147, where this mosquito is recorded as *A. ludlowi*]. From a comparison of *A. hatorii*, Koidz., with material in the British Museum, Yamada considered it to be distinct from *A. ludlowi* [xiv, 200], but it appears from his description that the comparison was made with specimens of *A. litoralis*, and not with the true *A. ludlowi*. *A. hatorii* may be a geographical variety of the latter but Yamada's detailed description does not show differences sufficiently distinct to separate it. Larvae of *A. parangensis*, Ludl., were taken in a fresh water pool near the coast on Mindanao, and a few adults were reared from them. This material agrees well with the description of the species given by Rodenwaldt [xiii, 111], with the possible exception of certain characters of the male genitalia that were not mentioned by him but may have been merely overlooked. A comparison of *A. subpictus* var. *indefinitus*, Ludl., from the Philippines with typical *A. subpictus*, Grassi, from India suggests that the former is a distinct species, but it is retained as a variety for the present in order to avoid the confusion resulting from the previous misapplication of the name to *A. vagus*, Dön. The Philippine form has sometimes been identified as *A. subpictus* var. *malayensis*, Hacker ; the two may be distinct, but in any case the name *indefinitus* antedates *malayensis*. Slight differences revealed by a comparison of the larvae of the two forms are given. The Philippine form of *A. vagus* is considered a distinct variety, *limosus*, n., as a comparison of the larvae with those of the typical form from Java revealed differences in the posterior clypeal hairs. Keys to the adults and larvae of the five Philippine species discussed are given.

CURRY (D. P.). **Some Observations on the *Nyssorhynchus* Group of the *Anopheles* (Culicidae) of Panama.**—*Amer. J. Hyg.*, xv, no. 2, pp. 566–572, 6 figs., 3 refs. Baltimore, Md., March 1932.

An account is given of the distinguishing characters, breeding-places and distribution of four forms of the *Nyssorhynchus* group of *Anopheles* occurring in Panama. Larvae of *A. strodei*, Root, which are never very plentiful, are usually found during the early part of the dry season along the grassy margins of fresh pools and quiet streams on the Pacific side of the Isthmus. Larvae of *A. bachmanni*, Petrocchi, are frequently present in the inlets of Gatun Lake and other bodies of still water, but only within the crowns of water-lettuce (*Pistia stratiotes*). Two forms of *A. tarsimaculatus*, Goeldi, occur in the Canal Zone, which are named *A. tarsimaculatus* var. *aquasalis*, n., and *A. tarsimaculatus* var. *aquacaelestis*, n. Their distinguishing characters are constant and do not intergrade even when the two varieties are found breeding within the same square mile of territory. Larvae of var. *aquasalis* have only been found in brackish water in the lowlands of the Atlantic side of the Isthmus, preferring well-shaded places. They occur in abundance at times in the enormous tidal flats. The adults bite man freely and have a relatively long range of flight. Larvae of var. *aquacaelestis*, which also prefer shady places, have been taken in numbers from fresh water pools on the Atlantic side of the Isthmus at elevations above the reach of tides ; they have not been taken in brackish water. The adults are not usually found in houses and do not appear to attack man readily, though they have been observed to do so in densely shaded jungle swamps. The author considers that the characters distinguishing the two forms may be of specific value, but is unable to settle their systematic status as he does not know definitely the characters or breeding-places of the typical *A. tarsimaculatus*. Certain specimens from Trinidad, which appear to be identical with var. *aquasalis*, are stated to have been taken from both fresh and salt water ; they are reported to be active vectors of malaria, whereas var. *aquasalis* does not seem to play an important part in the transmission of the disease. Var. *aquacaelestis* is similar in appearance to *A. tarsimaculatus* var. *oswaldoi*, Peryassú, from Brazil, but no specimens of the latter were available for comparison, and the author has no knowledge of its breeding-places. Male and female specimens similar to var. *aquacaelestis* have been obtained from Trinidad, and this distribution is additional evidence that this variety will be found to be identical with *oswaldoi*.

Mooij (W.). **De malariabestrijding te Tanahmerah, Bovendigoel.** [Malaria Control at Tanahmerah, Upper Digoel.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 2, pp. 66–82, 4 charts, 1 map. Batavia, 15th January 1932.

This is a report on successful work against malaria, begun in February 1930 and consisting of plasmochin prophylaxis and anti-larval measures, at certain military and prison camps in Dutch New Guinea. Mosquito control was directed against *Anopheles punctulatus* var. *moluccensis*, Swell., its breeding-places in cleared land being drained or sprayed weekly with petroleum residue. Adult catches showed that the proportion of Anophelines to Culicines was reduced, and only half the number of Anophelines was caught from March 1930 to February 1931 as compared with the period July 1928 to June 1929. In both periods *A. bancrofti*, Giles, outnumbered *A. punctulatus* var. *moluccensis* by about 3 to 1, so that it had evidently been equally affected by the measures directed against the latter.

Clark (H. C.) & Dunn (L. H.). **Experimental Studies on Chagas' Disease in Panama.**—*Amer. J. Trop. Med.*, xii, no. 1, pp. 49–77, 8 refs. Baltimore, Md., January 1932.

Records are given of five cases of Chagas' disease occurring between 1st December 1930 and 20th August 1931 in Panama, where the disease was not previously known. A young dog and a squirrel from dwellings in which some of the cases occurred, together with armadillos, opossums and bats, were found to be naturally infected with a trypanosome believed to be *Trypanosoma cruzi*. *Panstrongylus* (*Triatoma*) *geniculatus*, Latr., was found in numbers in the caves from which the infected bats and one of the infected opossums were collected, and examination of the faeces of 18 of these bugs revealed trypanosomes in 10. Of 26 guineapigs, each inoculated with a macerated bug, 21 became infected. Seven guineapigs became infected when bugs were allowed to feed on them, but in these cases also the infections may possibly have been caused by their faeces. No serious symptoms developed in the infected persons or animals under observation.

SELLARDS (A. W.). **Technical Precautions employed in maintaining the Virus of Yellow Fever in Monkeys and Mosquitos.**—*Amer. J. Trop. Med.*, xii, no. 1, pp. 79–92, 5 figs., 4 refs. Baltimore, Md., January 1932.

The virulence of a strain of yellow fever has been maintained in monkeys [*Macacus*] and *Aëdes argenteus*, Poir. (*aegypti*, auct.) over a period of 3½ years in the laboratory at Boston, Mass., during which time no infections have been acquired from either monkeys or mosquitos. An account is given of the technique employed in handling large numbers of mosquitos with the minimum amount of work and to avoid the tedious necessity of recording the exact numbers of infected individuals kept on hand. Descriptions are given of the special mosquito traps by means of which several mosquitos may be removed at one time from a cage of infected ones without allowing an opportunity for any to escape, and of breeding cages with long sleeves that enable the handling to be done from outside the cage.

DAVIS (N. C.) & KUMM (H. H. W.). **Further Incrimination of *Anopheles darlingi* Root as a Transmitter of Malaria.**—*Amer. J. Trop. Med.*, xii, no. 1, pp. 93–95, 1 ref. Baltimore, Md., January 1932.

In February 1931 an Anopheline survey was made of a small town in Bahia, at the time of a malaria epidemic. Breeding, which was intense, occurred only along the edges of a stream more than 220 yards from the nearest house. In collections of larvae and of adults taken at night with animal bait *Anopheles albitarsis*, Arrib., predominated, but *A. tarsimaculatus*, Goeldi, *A. argyritarsis*, R.-D., *A. darlingi*, Root, and *A. bachmanni*, Petrocchi, were also present. Dissections of *A. darlingi*, which was the only species found in houses, revealed malarial parasites in 66 of the 240 stomachs examined and in 16 of the 215 salivary glands [*cf. R.A.E.*, B, xix, 188].

SHANNON (R. C.). **Criadouros de mosquitos em depositos artificiaes encontrados nos terrenos baldios, zona de Nazareth, Bahia.** [Artificial Breeding-places of Mosquitos in Waste Grounds in the Nazareth Quarter, Bahia.]—*O Saneamento*, viii, no. 10, 4 pp. Rio de Janeiro, April 1930. [Recd. March 1932.]

This is a report on the breeding of *Aëdes* (*Stegomyia*) [*argenteus*, Poir.] and other mosquitos in empty tin cans and other artificial receptacles lying in waste grounds in Bahia, Brazil. In one quarter of the town 6,784 examples of *A. argenteus* were obtained from 284 containers.

SHANNON (R. C.). **Outras experiencias sobre o desenvolvimento das larvas de *Stegomyia* numa vasilha de cobre e numa talha Salus.** [Further Experiments on the Development of Larvae of *Aëdes argenteus* in a Copper Vase and in a Salus Urn.]—*O Saneamento*, viii, no. 11, 2 pp. Rio de Janeiro, May 1930. [Recd. March 1932.]

Larvae hatching from eggs of *Aëdes* (*Stegomyia*) [*argenteus*, Poir.] in a copper vase all died in about 8 days, even though the water was changed daily. The dead larvae were smaller than normal ones of the same age. In a silver urn some larvae lived for 20 days and were of normal size.

SHANNON (R. C.). **Relatorio de uma inspecção de mosquitos na cidade de Bomfim, Bahia, Brazil.** [Report on a Mosquito Survey in the Town of Bomfim in Bahia, Brazil.]—*O Saneamento*, viii, no. 11, 2 pp. Rio de Janeiro, May 1930. [Recd. March 1932.]

Of 77 houses examined in January 1930 in the town of Bomfim, about 200 miles from the coast, in the State of Bahia, 44 contained breeding-places of *Aëdes* (*Stegomyia*) [*argenteus*, Poir.]. Of these breeding-places a number were water-tanks, of which four also contained larvae of *Anopheles argyritarsis*, R.-D. In channels and pools there were numerous larvae of *A. argyritarsis*, *A. albitarsis*, Arrib., and *A. tarsimaculatus*, Goeldi. Other Anophelines found were *A. parvus*, Chagas, *A. bachmanni*, Petrocchi, *A. strodei*, Root, and *Chagasia fajardoi*, Lutz.

SHANNON (R. C.). **Relatorio de uma rapida investigação de mosquitos in Recife.** [Report of a rapid Mosquito Survey in Recife.]—*O Saneamento*, viii, no. 12, 4 pp.; ix, no. 1, 4 pp. Rio de Janeiro. June-July 1930. [Recd. March 1932.]

Of the mosquitos observed at Recife, Brazil, at the beginning of the dry season, September 1929, the only Culicines numerous in houses were *Aëdes argenteus*, Poir. (*Stegomyia aegypti*, auct.) and *Culex fatigans*, Wied. (*quinquefasciatus*, Say). *Mansonia titillans*, Wlk., *Aëdes taeniorhynchus*, Wied., and *A. scapularis*, Rond., however, are also more or less troublesome. Four species of *Anopheles* were observed, *viz.*, *A. albitarsis*, Arrib., *A. argyritarsis*, R.-D., *A. tarsimaculatus*, Goeldi, which is known to transmit malaria at Recife, and *A. bachmanni*, Petrocchi. The breeding-places are described. The Anophelines were found in more or less clean water in artificial containers, but breed chiefly at the edges of lakes, and in channels and drains. Indoors, *Aëdes argenteus* bit by day, and *C. fatigans*, which was much more abundant, by night.

MACFIE (J. W. S.). **New Zealand biting Midges (Diptera Ceratopogonidae).**—*Ann. Trop. Med. Paras.*, xxvi, no. 1, pp. 23–53, 10 figs., 1 ref. Liverpool, 19th March 1932.

This paper gives the results of examination of 131 specimens of Ceratopogonids from New Zealand, including descriptions of 20 new species [*cf. R.A.E.*, B, xix, 240]. The collection does not include any individuals belonging to the genus *Culicoides* or other genera known to attack man.

KUMM (H. W.). **Observations on two Malaria Vectors and Distribution Records of other *Anopheles* in the States of Bahia and Sergipe, Brazil.**—*Ann. Trop. Med. Paras.*, xxvi, no. 1, pp. 1–6, 1 map, 9 refs. Liverpool, 19th March 1932.

The distribution of various species of *Anopheles* found in the States of Bahia and Sergipe is given in a table. Although the records are few, they indicate the wide occurrence of *A. albitarsis*, Arrib., *A. tarsimaculatus*, Goeldi, and *A. bachmanni*, Petrocchi. The records for *A. albitarsis* and *A. darlingi*, Root, are shown in a map. Malaria infection was found in 5·8 per cent. of the midguts of 240 individuals of *A. albitarsis* captured in the City of Bahia. In an epidemic of malaria in

Itapira *A. darlingi* was the only species found in houses, and infected individuals harboured numerous oöcysts. *A. albitarsis* and *A. tarsimaculatus* appear to be the commonest Anophelines in the State of Bahia.

GORDON (R. M.) & DAVEY (T. H.). *P. malariae* **in Freetown, Sierra Leone.**—*Ann. Trop. Med. Paras.*, xxvi, no. 1, pp. 65–84, 1 map, 2 graphs, 2 pp. refs. Liverpool, 19th March 1932.

A comparison of the incidence of quartan malaria in Freetown in 1931 with that found in 1924–26 revealed a general increase of infection with *Plasmodium malariae*, which tended to replace the malignant tertian parasite (*P. falciparum*) in contra-distinction to appearing as a super-added infection. The literature on the infection of Anophelines with *P. malariae* is discussed in detail, and the authors conclude that the evidence regarding its transmission by Anophelines rests on a very small basis of fact. *Anopheles gambiae*, Giles, and *A. funestus*, Giles, were the only Anophelines found in houses in Freetown, and in experiments in which they were fed on patients harbouring *P. malariae* none became infected.

EVANS (A. M.). **Notes on African Mosquitoes.**—*Ann. Trop. Med. Paras.*, xxvi, no. 1, pp. 85–108, 7 figs., 17 refs. Liverpool, 19th March 1932.

With regard to the description of the pupae of Anophelines, the author points out that owing to the extreme variability exhibited by the branching of many of the bristles, descriptions based on a study of only one or two examples of a species may have to be modified considerably when further material is examined. For this reason the pupal differences between closely allied species described by Senevet [*cf. R.A.E.*, B, xx, 69], although they may be of great value in separating these forms, should not be regarded as final. Thus, examination of further examples of pupae of *A. funestus*, Giles, has revealed variations in the branching of bristles sufficient in some cases to invalidate the key given by Senevet [*loc. cit.*]. The pupae of *A. obscurus*, Grünb., *A. kingi*, Christ., and *A. garnhami*, Edw., are described.

In an extensive survey of the mosquitos of Liberia carried out by Dr. M. A. Barber in February and March 1931, the following Anophelines were found in addition to *Anopheles gambiae*, Giles, and *A. funestus*, which were recorded in a paper already noticed [xix, 1] : *A. nili*, Theo., and *A. theileri* var. *hancocki*, Edw., of which some adults were taken indoors, *A. mauritianus* var. *paludis*, Theo., *A. hargreavesi*, Evans, *A. obscurus* and *A. obscurus* var. *nowlini*, n., *A. barberellus*, sp. n., *A. smithi*, Theo., which is recorded for the first time outside the environs of Freetown, Sierra Leone, and *A. cinctus*, Newst. & Cart., which has not been recorded since the original description of the species (1910) from a single incomplete female. Descriptions are given of the males, females, 4th stage larvae and pupae of the last-named species and the two new forms. *A. barberellus* is the species from the neighbourhood of Freetown previously referred to *A. domicolus*, Edw. [xiv, 64].

A re-examination of material of *A. freetownensis*, Evans [xix, 174] has led the author to give additional descriptive notes and to point out that this species can no longer be regarded as even closely allied to *A. marshalli*, Theo.

CORSON (J. F.). **Experiments on the Transmission of** *Trypanosoma brucei* **and** *Trypanosoma rhodesiense* **to Man.**—*Ann. Trop. Med. Paras.*, xxvi, no. 1, pp. 109–115. Liverpool, 19th March 1932.

After discussing the characteristics and possible relationships of *Trypanosoma gambiense*, *T. rhodesiense* and *T. brucei*, the author gives an account of experiments carried out in Tanganyika Territory.

The following is largely taken from his summary and conclusions: A strain of *T. brucei* that had been maintained by direct inoculation in various animals for 4½ years was found to be easily transmissible by tsetse-flies (*Glossina morsitans*, Westw., and *G. pallidipes*, Aust.) to guineapigs. Two European volunteers [including the author] did not become infected after having been bitten by these infective flies.

A strain of *T. rhodesiense* that had been maintained by direct inoculation in goats and sheep for 19 months was found to be easily transmissible by tsetse-flies of the above-mentioned species to guineapigs. A European volunteer [the author] inoculated subcutaneously with the blood of one of the infected guineapigs became infected, the incubation period being 6–7 days. The infection was transmitted by blood inoculation from him to rats. It may thus be said that a strain of *T. rhodesiense* had not become converted into *T. brucei* by being maintained for 19 months in goats and sheep.

It would seem that domestic animals should be taken into account as possible reservoirs of sleeping-sickness, and it is very desirable that work with antelopes should be undertaken in order to demonstrate whether *T. rhodesiense* would lose its infectivity for man when passed through a series of these animals.

GALLIARD (H.). **Culicides du Gabon. III.—Anophelinés.**—*Ann. Paras. hum. comp.*, x, no. 1, pp. 85–95, 6 figs., 12 refs. Paris, 1st January 1932.

Brief descriptions are given of the characters distinguishing the adults and larvae of *Anopheles mauritianus*, Grp., *A. funestus*, Giles, *A. pharoensis*, Theo., and *A. gambiae*, Giles, the adults of *A. hargreavesi*, Evans, and *A. wellcomei*, Theo., and the larva of *A. rufipes*, Gough. *A. hargreavesi* is the species previously recorded as *A. marshalli*, Theo. [*R.A.E.*, B, xx, 64]. The larva of an additional Culicine is described [*cf.* xix, 183; xx, 87].

LANGERON (M.). **A propos du** *Phlebotomus larroussei*.—*Ann. Paras. hum. comp.*, x, no. 1, p. 96, 3 refs. Paris, 1st January 1932.

The author points out that if, as suggested by Adler and Theodor [*R.A.E.*, B, xix, 218], *Phlebotomus larroussei*, Lngn. & Nitzu., and *P. vesuvianus*, Adl. & Thdr., are identical, the former is the earlier name. From an examination of the figures, the spermathecae appear to be distinct.

KATAGAI (T.). **The Anopheline Fauna in Taihoku, with Notes on the numerical Changes.** [*In Japanese.*]—*J. Med. Ass. Formosa*, xxx, no. 11, pp. 1276–1288. Taihoku, Formosa, November 1931. (With a Summary in English.)

Anopheles hyrcanus var. *sinensis*, Wied., *A. tessellatus*, Theo., and *A. maculatus*, Theo., were found in the city of Taihoku, the first-named being the most numerous, although the average daily captures have fallen from 6·95 during 1913–22 to 2·9 in 1927–30. *A. maculipalpis* var. *splendidus*, Koidz., and *A. fuliginosus*, Giles, were collected near the city, but *A. minimus*, Theo., although recorded from Taihoku long ago, was not found in or near it.

MORISHITA (K.). **Dengue Fever, especially recent Studies on it.** [*In Japanese.*]—*J. Med. Ass. Formosa*, xxx, no. 11, reprint 32 pp. Taihoku, Formosa, November 1931.

In the course of this paper it is stated that *Aëdes argenteus*, Poir. (*aegypti*, auct.) is generally found on the plains near the coast in Formosa and is common in the Pescadores Islands. *A. albopictus*, Skuse, is also common in the Islands.

BLANC (G.) & CAMINOPETROS (J.). **La fièvre boutonneuse (fièvre exanthématque de Marseille) en Grèce. Expèriences de transmission par la tique du chien** (*Rhipicephalus sanguineus*).—*Bull. Acad. Méd.*, (3) cv, pp. 620–624, 8 refs. Paris, 1931.

Brief descriptions are given of 9 series of experiments on Marseilles fever in which suspensions of numerous individuals of *Rhipicephalus sanguineus*, Latr., taken from dogs in the Piraeus, Volo and Athens, were inoculated into 33 persons. From the 13 cases in which positive results were obtained, it is concluded that both males and females of *R. sanguineus* may be infective and may harbour the virus during hibernation [*cf. R.A.E.*, B, xix, 134] ; that the virus may be transmitted by inoculation of the conjunctiva slightly injured by rubbing [xix, 92] ; and that ticks from different localities are not equally infective, since those from the maritime ports of the Piraeus and Volo were highly infective and those from Athens were negative.

MARCANDIER (—), PLAZY (—), LE CHUITON (—) & PIROT (R.). **Transmission au singe de la fièvre exanthématique observée à bord des navires de guerre à Toulon. Ses rapports avec le typhus exanthématique.**—*Bull. Acad. Méd.*, (3) cv, pp. 1012–1015. Paris, 1931

In the course of experiments on the inoculation of monkeys with the virus of the exanthematic fever occurring on warships at Toulon [*cf. R.A.E.*, B, xviii, 250 ; xx, 49], one monkey was inoculated in the conjunctiva with a suspension of 30 individuals of *Dermanyssus* [*muris*, Hirst] but no fever resulted. Moreover, this monkey gave a positive result when inoculated with the virus of typhus although monkeys that had reacted positively when inoculated with the blood of exanthematic fever patients gave negative results.

NETTER (A.). **Existence sur le littoral méditerranéen, en dehors d'une fièvre boutonneuse transmise par le** *Rhipicephalus sanguineus*, **commensal du chien, d'un typhus endémique bénin (maladie de Brill) transmis par un arthropode du rat, le** *Leiognathus bacoti*.—*Bull. Acad. Méd.*, (3) cv, pp. 1017–1021, refs. Paris, 1931.

In view of the fact that monkeys inoculated with the virus of the exanthematic fever (resembling Marseilles fever) occurring on warships at Toulon have been found to be immune from typhus [see preceding paper], the author suggests that there are two diseases present in the south of France, both showing similar clinical characters, *viz.*, Marseilles fever, which is transmitted by the tick, *Rhipicephalus sanguineus*, Latr. [*R.A.E.*, B, xix, 38, etc.] and is widely distributed in the Mediterranean basin, and a disease bearing the same relation to typhus as Brill's disease in the United States, which occurs in persons not exposed to ticks. In view of the negative result obtained in the single experiment on the transmission of the latter disease by *Dermanyssus muris*, Hirst [see preceding paper], the author suggests that *Liponyssus bacoti*, Hirst, which is found on rats in various parts of the world, may be the vector [*cf.* xx, 49].

QUÉRANGAL DES ESSARTS (J.) & PRADE (J. V.). **Un cas de fièvre exanthématique, observé à Brest.**—*Bull. Soc. Path. exot.*, xxv, no. 2, pp. 109–113. Paris, 1932.

A case of exanthematic fever is recorded from Brest. It originated on a warship from Toulon on which about 30 cases of exanthematic fever had been observed in previous years, the last occurring more than 6 months previously, but differed in certain characters from those believed now to be a benign form of typhus and from Marseilles fever [*cf.* preceding paper, etc.]. Neither *Pediculus* nor *Phthirus pubis*, L., was found on the man, and he had not been in contact with dogs or other domestic animals. Examination of the ship revealed no lice or bedbugs, and although *Polyplax* (*Haematopinus*) [*spinulosa*, Burm.], *Xenopsylla cheopis*, Roths., and *Dermanyssus muris*, Hirst, were found on the rats, they were shown on subsequent inoculation into guineapigs to be uninfected. *Liponyssus* (*Leiognathus*) *bacoti*, Hirst, was not observed.

KODAMA (M.), TAKAHASHI (G.), KOHNO (M.) & FUTAKI (Y.). **Natural Hosts and Disseminators of** *Rickettsia manchuriae* (**A Preliminary Note**).—*Kitasato Arch. Exptl. Med.*, ix, no. 1, pp. 84–89. Tokyo, February 1932.

It is considered that the causal agent of the benign sporadic typhus occurring in Manchuria is *Rickettsia manchuriae*, which is thought to be a form of the typical *R. prowazeki* produced by its adaptation to a new host, probably the rat. In experiments undertaken to determine the animal host and the insect vector of the disease, rats were collected from two epidemic foci and their fleas identified. The predominating species were *Xenopsylla cheopis*, Roths., and *Ceratophyllus anisus*, Roths. Inoculation of laboratory animals (chiefly male guineapigs) with emulsions of the brains of rats and of the different species of fleas showed that *R. manchuriae* is present in the rats and in *X. cheopis*, which infests both rats and man. The conclusions that rats harbour the parasite and that *X. cheopis* is at least one of the vectors are in accordance with those regarding the part played by rats and fleas in the dissemination of benign typhus in America.

COMBIESCO (D.). **Recherches expérimentales sur la fièvre exanthématique constatée à Constantza (Roumanie).**—*C. R. Soc. Biol.*, cix, no. 9, pp. 793–894. Paris, 1932.

An account is given of further investigations on the outbreak of Marseilles fever at Constantza [*R.A.E.*, B, xx, 23]. The epidemic ceased about 11th September, and a further search for ticks on dogs yielded barely a score of nymphs [of *Rhipicephalus sanguineus*, Latr.]. Some of the resulting adults, which emerged a month later, were ground up and injected into two women, both of whom became infected. Experiments with animals only partly confirmed those of Blanc & Caminopetros [*cf. R.A.E.*, B, xix, 224]. Rabbits, guineapigs and white rats inoculated with blood from a person suffering from the disease showed no sign of infection, but one man out of 6 became infected when inoculated with emulsions of organs from white mice infected from man. A positive result was obtained in one case out of four when man was inoculated with emulsions of the viscera of *Citellus citellus*. Two dogs from Bucarest (a locality from which Marseilles fever has not yet been recorded) inoculated with human blood showed no symptoms of the disease, but infection resulted on sub-inoculation into a monkey (*Macacus rhesus*).

LÉPINE (P.). **Sur la présence, dans l'encéphale des rats capturés à Athènes, d'un virus revêtant les caractères expérimentaux du typhus exanthématique (virus mexicain).**—*C. R. Acad. Sci.*, cxciv, no. 4, pp. 401–403, 1 ref. Paris, 25th January 1932.

LÉPINE (P.), CAMINOPETROS (J.) & PANGALOS (G.). **Présence du virus du typhus exanthématique chez les puces des rats d'Athènes et du Pirée.**—*C. R. Soc. Biol.*, cix, no. 9, pp. 710–712, 4 refs. Paris, 1932.

In the first paper an account is given of the discovery of the virus of exanthematic typhus in the brains of rats captured in Athens and the Piraeus, where a certain number of cases of typhus occur annually. Intraperitoneal inoculation of rat brains into guineapigs produced symptoms suggestive of experimental typhus in these animals, with the exception of two, and these resemble those produced by benign typhus in Mexico [*R.A.E.*, B, xx, 50].

The second paper gives the results of experiments in which suspensions of fleas from rats trapped in Athens and the Piraeus were inoculated into guineapigs. Positive results were constantly obtained when a suspension of at least 12 fleas was injected, whether they were exclusively *Xenopsylla cheopis*, Roths., or *Leptopsylla segnis*, Schönh. (*musculi*, Dug.), or a mixture of undetermined fleas. When a suspension of only 2 fleas was used, positive results were obtained in three cases out of four with *X. cheopis* and in one out of two with *L. segnis*. The great virulence of this material (as shown by the short incubation period and the intensity of the reactions caused in the guineapig) in comparison with the virulence of the blood or even the brain of rats, suggests an active multiplication of the virus within the flea. Although it is possible that other fleas may become infected, the predominance of *X. cheopis* among the rat fleas of Athens and the frequency with which it is infected with the virus indicate that it plays an important part in the transmission of typhus from rat to rat and probably from rat to man.

DURAND (P.). **Le chien réservoir de virus de la fièvre boutonneuse.**—*C. R. Acad. Sci. Fr.*, cxciv, no. 10, pp. 918–919. Paris, 1932.

Inoculation experiments with examples of *Rhipicephalus sanguineus*, Latr., obtained from Tunis, showed that the virus of Marseilles fever can develop in the dog without being apparent, blood from such an infected dog causing the disease as readily as that from an infected man. Previous failures in similar experiments are possibly due to dogs in regions where the tick occurs having an immunity acquired by earlier infection.

Sergent (Et.). **Les épidémies de paludisme et la météorologie en Algérie.**—*Bull. Soc. Path. exot.*, xxv, no. 2, pp. 133–136, 2 graphs. Paris, 1932.

Since 1902 three severe outbreaks of malaria have occurred in Algeria, in 1904, 1916–17 and 1928. In an attempt to correlate these outbreaks with meteorological conditions, the graphs for rainfall and sunspots (the influence of which on rainfall is now acknowledged) alone showed the same general curves. It is concluded that a serious outbreak of malaria in Algeria can be predicted, but only up to a certain point and at the beginning of the summer, the most important cause being the degree of rainfall.

Mazza (S.). *Triatoma geniculata* **agent de transport de** *T. cruzi.* **Nouveaux cas de fièvre de Malte en Argentine.**—*Bull. Soc. Path. exot.*, xxv, no. 2, pp. 145–146, 1 ref. Paris, 1932.

The author records the presence of *Panstrongylus* (*Triatoma*) *geniculatus*, Latr., in a locality in the north of the Province of Santa Fé, Argentina, where armadillos and opossums were found to be naturally infected with *Trypanosoma cruzi*.

Galliard (H.). **Recherches sur les filarioses au Gabon occidental.**—*Bull. Soc. Path. exot.*, xxv, no. 2, pp. 167–174, 13 refs. Paris, 1932.

An account is given of the incidence of *Filaria* (*Loa*) *loa*, *F. perstans* and *Onchocerca volvulus* in Gabun, where the probable respective vectors, *Chrysops dimidiata*, Wulp, *Culicoides grahami*, Aust., and *Simulium damnosum*, Theo., have been found. The last-named is scarce in the dry season, but in the rains it seems to be commoner along the rivers on the borders of the forest zone. *F. bancrofti* was not found.

Mathis (C.). **Les spirochétoses récurrentes en Afrique Occidentale française.**—*Bull. Acad. Méd.*, (3) xvi, no. 31, pp. 188–198. Paris, 1931.

Present knowledge on relapsing fevers in French West Africa is reviewed. Relapsing fever caused by *Spirochaeta recurrentis* and transmitted by lice [*Pediculus*] was first recognised in epidemic form in 1921. It is thought that native soldiers returned from Morocco and Algeria, where foci of relapsing fever were known to exist, may have introduced the disease. An account is given of its spread, which followed the routes used by pilgrims and caravans and radiated to adjacent villages. The localities from which the disease was recorded each year from 1921 to 1929 (when the epidemic died out) are given. The method of its transmission and the measures used for its control are discussed.

The history of relapsing fever at Dakar is reviewed from the discovery of a spirochaete in the shrew [*R.A.E.*, B, v, 98] and its identity with that occurring in man [xvi, 239] to its determination as a form of *Spirochaeta duttoni* (var. *crocidurae*) [xvi, 265] and finally to the discovery of the probable arthropod vector in *Ornithodorus erraticus*, Lucas [xx, 82].

[Kolpakova (S. A.).] **Колпакова (С. А.). Materials for the Study of the Tick Fauna in the District of the Lbishchensk Region (western Kazakstan), where Plague is endemic.** [*In Russian.*]—*Rev. Microbiol*, x, no. 3, pp. 271–274. Saratov, 1931. (With a Summary in German.)

During a study in 1930 of the conditions under which outbreaks of plague occur among rodents in a district on the river Ural in western Kazakstan, *Rhipicephalus schulzei*, Olenev, was collected on ground squirrels (*Citellus pygmaeus*) and in their nests from mid-May till mid-September [*cf. R.A.E.*, B, xviii, 270, etc.]. The seasonal occurrence and numbers of the various stages of this tick are shown in tables. The presence of adult ticks in May indicates that hibernation occurs in that stage, eggs being probably laid in early spring. The larvae hatched in May, and nymphs were found on ground squirrels in June. Their numbers decreased in July, whereas the adults became more abundant, and no larvae or nymphs were found in nests in August and September. *R. schulzei* was also found on *Putorius eversmanni* and in small numbers on man and on rodents other than *C. pygmaeus*.

[Zasukhin (D. N.).] **Засухин (Д. Н.). Materials on the Biology of the Tick,** *Dermacentor niveus* **Neum. 1897. Communication ii.** [*In Russian.*]—*Rev. Microbiol.*, x, no. 3, pp. 275–282, 1 fig. Saratov, 1931. (With a Summary in German.)

An account is given of observations in 1929 and 1930 in western Kazakstan on *Dermacentor niveus*, Neum., which is widely distributed on domestic animals in the Russian Union [*R.A.E.*, B, xvi, 84, 266] and sometimes attacks man. Isolated adults were found on *Citellus pygmaeus* and *Marmota bobak*. In the laboratory, unfed adult females and males taken from domestic animals in spring or summer lived without food for 8 and 3 months respectively at 17–19·5°C. [62·6–67·1° F.], provided that there was a sufficient degree of humidity, whereas under dry conditions they died in 10–12 days. Oviposition occurred in May at intervals varying from 2 to 19 days after feeding, the number of eggs laid being in direct proportion to the extent of the engorgement of the female and varying from a few dozen to 3,000 [*cf.* xvi, 266]. The eggs hatched in 20–36 days at 18–19°C. [64·4–66·2°F.] and in 15 days at a higher temperature. They were not affected by excessive moisture and even hatched under water, whereas under dry conditions they were killed in 5–8 days. The larvae lived 30 days or more at 17–19°C. in a humid environment, but died in 2–5 days in a dry one. In the laboratory, the larvae and nymphs could only be induced to feed on small rodents. Engorgement required about 3–5 days, and metamorphosis from larva to nymph and from nymph to adult 12–19 and 14–26 days respectively [*cf.* xvi, 202]. The young adults did not feed for 20 days. There was only one generation a year, hibernation occurring as an immature adult.

In the field, the ticks appeared in the steppe when the snow melted, and attacked horses, cattle and camels, being especially abundant in April. Their numbers, however, greatly decreased at the end of this month, though isolated individuals, chiefly males, were found on cattle as late as June. The engorged females dropped off the host, but the place of oviposition could not be ascertained. The males died after pairing. Neither larvae nor nymphs were found on cattle, but they were numerous on hamsters (*Cricetus*) and hedgehogs, and sometimes occurred on jerboas (*Alactaga*), the larvae in mid-June and the nymphs in the second half of the month and the first half of July. Young adults were present in the second half of July, but only very seldom on cattle and horses, and disappeared late in the autumn, having probably entered hibernation. The ticks commonly found in numbers on cattle in western Kazakstan in winter are nymphs of *Hyalomma uralense*, Schulze & Schłottke.

It is probable that *D. niveus* is the vector of *Piroplasma caballi*, outbreaks of which occur in western Kazakstan at the time when the horses are infested by the overwintered ticks. Moreover the incidence of piroplasmosis is heavier in rainy years, which may be correlated with the fact that the ticks are favoured by the excessive dampness. As the larvae and nymphs occur on rodents and the adults on camels, which are also subject to this disease [x, 220], it is possible that the ticks may transmit plague from the rodents to camels and from the latter to man [*cf.* x, 220].

[Khodukin (N. I.) & Sofiev (M. S.).] **Ходукин (Н. И.) и Софиев (М. С.). On the Anticoagulins and Agglutinins in the Organs of Central-Asiatic Ticks of the Genus** *Ornithodorus*. [*In Russian.*]—*Rev. Microbiol.*, x, no. 3, pp. 283–285. Saratov, 1931. (With a Summary in German.)

In a study of the presence of anticoagulins and agglutinins in *Ornithodorus lahorensis*, Neum., and *O. papillipes*, Bir., it was found that the lymph taken from the coxae of *O. lahorensis* possessed as strong anticoagulins as that from *O. papillipes*, unless the individuals of *O. lahorensis* had oviposited, in which case their lymph contained none. The same was also true of agglutinins. The salivary glands of *O. lahorensis* produced less anticoagulin than those of *O. papillipes* [*cf. R.A.E.*, B, xvii, 227], and they only contained agglutinins if the ticks had oviposited. Emulsions prepared from parts of the digestive tract of *O. lahorensis* contained no agglutinins.

Dunn (L. H.). **Notes on the Tick,** *Ornithodorus talaje* **(Guér.), infesting a House in the Canal Zone.**—*Psyche*, xxxviii, no. 4, pp. 170–174. Cambridge, Mass., December 1931.

Nymphs and an adult of *Ornithodorus talaje*, Guér., are recorded as attacking man in a house at Gatun, Panama Canal Zone. It is thought that larval ticks had been brought into the house on rats that had previously infested the building, and that after the rodents had been destroyed, the nymphs had been forced to seek blood meals from man.

Bequaert (J.). **Notes on Hippoboscidae. 3. Hippoboscidae of Yucatan.**—*Psyche*, xxxviii, no. 4, pp. 186–193. Cambridge, Mass, December 1931.

Among the Hippoboscids discussed is *Olfersia* (*Pseudolfersia*) *coriacea*, Wulp (*P. meleagridis*, Lutz, Neiva & Lima), a parasite of gallinaceous birds, which has been reported to attack man occasionally. It is suspected by the inhabitants of Yucatan and northern Guatemala of being the vector of " bay-sore " or human cutaneous leishmaniasis, a disease of man in the humid, densely afforested areas of the Yucatan Peninsula, British Honduras and Guatemala.

KNOWLES (R.), DAS GUPTA (B. M.) & BASU (B. C.). **Studies in Avian Spirochaetosis. Parts I & II.**—*Ind. Med. Res. Mem.*, no. 22, 113 pp., 11 pls., 1 chart, 11 pp. refs. Calcutta, February 1932.

The first part of this paper comprises a detailed and comprehensive review of the literature on avian spirochaetosis from 1891–1930. In the second part a further account is given of investigations carried out at Calcutta from 1927–1931 on the disease, its causal organism, *Spirochaeta anserina*, and its invertebrate host, *Argas persicus*, Oken, a preliminary account of which has already been noticed [*R.A.E.*, B, xviii, 90].

Fowls became infected when bitten by infected individuals of *A. persicus*, or when infected ticks or eggs laid by them were ingested. Pigeons and various wild birds inoculated with infected blood contracted the disease, but in pigeons the spirochaetes gradually become attenuated and finally non-virulent, and it therefore appears unlikely that they act as hosts in nature. Atmospheric temperature does not seem to affect the development of the spirochaete within the tick to any significant extent, and transmission is apparently possible at all times of the year. The preliminary feeding of a tick on an immune fowl prior to its infecting feed appears to accelerate the development of the spirochaete, and the tick becomes infective by biting on the first day after the infecting feed.

Dissections of the lice, *Lipeurus caponis*, L., and *Menopon gallinae*, L. (*pallidum*, Nitz.), taken from fowls when the disease was at its height, revealed no spirochaetes. Actively motile spirochaetes were found in 10 out of 11 batches of mites (*Dermanyssus gallinae*, DeG.) up to the third day after they were taken from fowls, but few dividing forms were seen and there does not appear to be any real multiplication of the parasites in the gut. It seems improbable that this mite plays any part in the transmission of avian spirochaetosis. In bed-bugs (*Cimex hemiptera*, F.) fed on fowls at the height of infection, very scanty motile spirochaetes were seen in the gut up to 24 hours after the feed. The spirochaetes died out rapidly, and as examination of the viscera and salivary glands invariably gave negative results, it is concluded that bed-bugs are incapable of transmitting the infection. Morphologically *S. anserina* is very similar to, or even indistinguishable from, mammalian spirochaetes of the relapsing fever group, but attempts to infect various small mammals and cold-blooded vertebrates with it were unsuccessful, positive results being obtained with avian hosts only.

NIESCHULZ (O.) & BOS (A.). **Enkele overbrengingsproeven van Hoenderpest door** *Culex pipiens*. [Some Experiments in the Transmission of Avian Plague by *C. pipiens*.]—*Ned. Tijdschr. Hyg. Microbiol. Serol.*, vi, no. 3, pp. 174–182. Leiden, 1931. (With a Summary in German.)

As previous experiments [*R.A.E.*, B, xix, 237] had indicated that *Aëdes argenteus*, Poir. (*Stegomyia aegypti*, auct.) is not a vector of poultry typhus, attention was directed to *Culex pipiens*, L. Mosquitos that had fed on an infected fowl and had been kept at 20°C. [68°F.] were ground up and injected intramuscularly into fowls. Infection was produced by mosquitos kept for 5 days, but after intervals of 10–25 days the results were negative. In mosquitos kept at 26–28°C.

[78·8–82·4°F.] the virus was also evident for 5 days. At lower temperatures of 10–12°C. [50–63·6°F.] the mosquitos were positive up to 15 days. It is concluded that the virus of poultry typhus does not therefore develop in *C. pipiens* and that the latter is not a natural vector of the disease.

Bos (A.). **Overbrengingsproeven van hoenderpokken door** *Anopheles maculipennis* **Mg.,** *Theobaldia annulata* **Schr., en** *Stomoxys calcitrans.* [Experiments in the Transmission of Fowl Pox by *A. maculipennis*, *T. annulata* and *S. calcitrans.*]—*Tijdschr. Diergeneesk.*, lix, no. 3, reprint 3 pp., 2 pls. The Hague, 1932. (With a Summary in German.)

Previous work on the transmission of fowl-pox by blood-sucking insects is briefly reviewed [*R.A.E.*, B, xviii, 127 ; xix, 239, etc.]. In experiments with *Anopheles maculipennis*, Mg., and *Theobaldia annulata*, Schr., which are very numerous in Holland, the former transmitted the disease by biting in 3–70 days after the infective blood-meal, and the latter in 5–70 days. With *Stomoxys calcitrans*, L., transmissions resulted in 1–15 days.

Parker (R. R.), Philip (C. B.) & Davis (G. E.). **Tularaemia : Occurrence in the Sage Hen,** *Centrocercus urophasianus.* **Also Report of additional Cases following Contacts with Quail,** *Colinus virginianus.*—*Publ. Hlth. Rep.*, xlvii, no. 9, pp. 479–487, 10 refs. Washington, D.C., 26th February 1932.

The following is largely taken from the authors' summary : An investigation into the mortality that occurred among sage hens in a locality in Montana during 1931 led to the recovery of *Bacterium tularense* from the tissues of dead birds and from ticks (*Haemaphysalis cinnabarina*, Koch) with which the birds were infested. It is not known whether *B. tularense* was the cause of the epizootic or a secondary or incidental factor. In comparison with sage hens taken outside the affected area, those within were found to be more often infected with tularaemia and more heavily infested with ticks ; moreover infected ticks were only obtained from the latter birds.

An account is given of cases of tularaemia in man in which the infection was possibly contracted when dressing infected birds.

Bishopp (F. C.) & Wood (H. P.). **Mites and Lice on Poultry.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 801 (revd.), 19 pp., 15 figs. Washington, D.C., August 1931. [Recd. March 1932.]

This revision of a previous bulletin [*R.A.E.*, B, xiv, 214] includes information on the use of nicotine sulphate against mites and lice on poultry [*cf.* xix 139, 182.].

Ewing (H. E.). **Early Records and Present Known Distribution in the United States of Three Recently Introduced Mites.**—*Proc. Ent. Soc. Wash.*, xxxiv, no. 2, pp. 13–16, 4 refs. Washington, D.C., February 1932.

The author draws attention to the frequence of inaccuracy in determining the exact date and place of the first occurrence of an introduced pest, and deals with the early records and present distribution in the United States of *Eulaelaps stabularis*, Koch (stable rat mite), *Liponyssus bacoti*, Hirst (tropical rat mite) and a mite attacking box trees. The only records of *E. stabularis* are three separate ones from rats in Baltimore, Maryland, during the first half of 1929. This mite, although found in human habitations in Europe, is not apparently known to attack man. The first published date of the occurrence of *L. bacoti* was on mice in New York City in December 1919, but recent investigations have shown that it had been found on a mouse in Missouri prior to October 1916. The first case of a serious attack on man to be investigated was probably in Mississippi early in 1921, when the mite caused the living quarters of a station building to be abandoned. It was finally eradicated by killing the rats. Reference is made to the occurrence of *L. bacoti* in Texas [*R.A.E.*, B, xii, 3; xix, 178], and other records based on specimens in collections are given.

Ciurea (I.) & Stephanescou (T.). *Argas persicus* **comme parasite de l'habitation humaine.**—*Bull. Soc. roum. Dermat. Syph.*, no. 2, reprint 4 pp., 2 figs. 1929. (Abstract in *Trop. Dis. Bull.*, xxix, no. 4, p. 277. London, April 1932.)

A case is recorded from Rumania of an infestation by *Argas persicus*, Oken, of bedrooms in an upper flat in a new concrete building, where there was no history of contact with pigeons or fowls. The ticks attacked the inhabitants of the room nightly, but it was impossible to find where they were sheltering.

Pinto (C.). **Valor do rostro e antenas na caracterização dos generos de Triatomideos. Hemiptera. Reduvidioidea.** [The Value of the Proboscis and Antennae in characterising the Genera of Triatomid Bugs].—*Bol. biol.*, 1931, fasc. 19, pp. 45–136, 70 figs., 1 table. Rio de Janeiro, 20th December 1931.

Continuing previous work [*cf. R.A.E.*, B, xv, 47, 235], this paper discusses the value of the proboscis and antennae in differentiating the various genera of these bugs. The species dealt with include the following, formerly referred to the genus *Triatoma*: *Panstrongylus bouvieri*, Larr., *P. geniculatus*, Latr., *P. lutzi*, Neiva & Pinto, *P. megistus*, Burm., *P. rufotuberculatus*, Champ., *P. tenuis*, Neiva, *Eutriatoma carrioni*, Larr., *E. flavida*, Neiva, *E. gomesi*, Neiva & Pinto, *E. maculata*, Erichs., *E. maxima*, Uhler, *E. oswaldoi*, Neiva & Pinto, *E. petrocchii*, Pinto & Barros Barreto, *E. rubrovaria*, Blanchard, *E. sordida*, Stål, *E. venosa*, Stål, and *Neotriatoma* (gen. n.) *circummaculata*, Stål.

Vandenberg (S. R.). **Report of the Entomologist.**—*Rep. Guam Agric. Expt. Sta. 1930*, pp. 23–25. Washington, D.C., 1931.

Distribution of *Spalangia* sp. against the house-fly [*Musca* sp.] and the stable-fly [*Stomoxys calcitrans*, L.] in Guam was continued during 1930 [*R.A.E.*, B, xix, 219]. Breeding operations were terminated because the parasites are now established round the station livestock buildings (75 to 85 per cent. of the pupae being parasitised), and a plentiful supply can be obtained for redistribution at any time. The fact that the periods during which the flies are normally scarce are becoming longer and those during which they are abundant are growing shorter does not appear to be due to the seasonal variation in rainfall, a factor that greatly influences the abundance of the flies, and further demonstrates the effectiveness of the parasite.

PAPERS NOTICED BY TITLE ONLY.

KEMPER (H.). **Beiträge zur Biologie der Bettwanze** (*Cimex lectularius* **L.). iii. Ueber den Mechanismus des Stech-Saugaktes.** [Contributions to the Biology of the Bed-bug (*C. lectularius*). iii. The Mechanism of the Act of Biting and Sucking.]—*Z. Morph. Oekol. Tiere*, xxiv, no. 3–4, pp. 491–518, 16 figs., 27 refs. Berlin, 20th February 1932.

FÜLLEBORN (F.). **Ueber den Saugakt der Stechmücken.** [On the Act of Sucking by Mosquitos (*Anopheles maculipennis*, Mg.)].—*Arch. Schiffs- u. Tropenhyg.*, xxxvi, no. 4, pp. 169–181, 5 figs., 6 refs. Leipzig, 1932.

SHANNON (R. C.). **Larvas e nymphas dos mosquitos communs do Brazil.**—*O Saneamento*, viii, no. 7, 3 pp., 8 figs. Rio de Janeiro, January 1930. [Recd. March 1932.]

KRÖBER (O.). **Das Genus** *Esenbeckia* **Rondani und die** *Gymnochela*-**Untergattung** *Amphichlorops* **Lutz (Dipt., Tabanidae).** [Revision of the Genus *Esenbeckia* and of the Subgenus *Amphichlorops* of *Gymnochela*, with a key to the species including one new one.]—*Rev. Ent.*, ii, fasc. 1, pp. 52—93, 32 figs. S. Paulo, 23rd January 1932.

CASTRO (G. M. DE OLIVEIRA). **Estudo sobre uma especie de** *Culex*, **que se cria em buracos de guayamú (Dipt., Culicidae).** [A Study of a Species of *Culex*, *C. carcinoxenus*, sp. n., breeding in Holes of *Cardisoma guanhumi* in Brazil.]—*Rev. Ent.*, ii, fasc. 1, pp. 97–105, 10 figs. S. Paulo, 23rd January 1932.

BONNE-WEPSTER (J.). **A Mosquito** [*Ficalbia hybrida*, Leic., in Java] **with larval Habits like** *Taeniorhynchus*.—*Bull. Ent. Res.*, xxiii, pt. 1, p. 69–72, 3 figs. London, March 1932.

BRUG (S. L.). **Notes on Dutch East Indian Mosquitos** [including 6 new species and one new variety of Culicines.]—*Bull. Ent. Res.*, xxiii, pt. 1, pp. 73–83, 11 figs. London, March 1932.

TEGONI (G.) & WILLIAMS (B. A.). **Indice bibliografico della Malaria. V. 1930.**—*Riv. Malariol.*, x, Suppl., 124 pp. Rome, 1931. [*Cf. R.A.E.*, B, xix, 216.]

GIL COLLADO (J.). **La** *Glossina tabaniformis* **Westw. en la Guinea Española (Dipt. Musc.).** [*G. tabaniformis* recorded for the first time in Spanish Guinea.]—*Conf. Res. cient. Soc. españ. Hist. nat.*, vi, no. 1–2, pp. 55–56, 1 ref. Madrid, 30th November 1931.

SCHUURMANS STEKHOVEN (J. H.). **The Bloodsucking Arthropods of the Dutch East Indian Archipelago. X. Further Notes on Tabanids of India, Sumatra, Java, Borneo, Celebes and some of the Moluccas. (Fourth Supplement to my Monograph : The Tabanids of the Dutch East Indian Archipelago.)** [Including 13 new species.]—*Arch. Naturg.*, Abt. A, (N.F.) i, no. 1, pp. 57–94, 22 figs., 16 refs. Leipzig, January 1932.

OUDEMANS (A. C.). **Acarologische Aanteekeningen cxi.** [Acarological Notes cxi.]—*Ent. Ber.*, viii, no. 182, pp. 312–331. Amsterdam, 1st November 1931. [Recd. February 1932.]

The species dealt with include *Liponyssus bacoti*, Hirst, recorded as attacking man indoors at Hamburg, having probably migrated from rats or mice poisoned in an adjoining warehouse.

SILER (J. F.). **Report of the Health Department of the Panama Canal for the Calendar Year 1930.**—8vo, 126 pp. Balboa Heights, C.Z., 1931. [Recd. March 1932.]

D. P. Curry contributes a report on the Division of Sanitation (pp. 73–95) in which it is stated that observations extending over many years in the Panama Canal Zone indicate that although *Musca domestica*, L., and *Stomoxys calcitrans*, L., breed throughout the year, they are most numerous in April–June, the beginning of the rainy season. As a whole, the Canal Zone and the two terminal cities, Colon and Panama, are singularly free from flies, but if suitable breeding-places are available, they multiply very rapidly and soon become a pest. The necessity for growing fresh vegetables on poor soil makes it essential to use fertilisers, the cheapest of which is manure. Unfortunately this is also the most attractive substance known for the breeding of *Musca* and *Stomoxys*, and experiments have been carried out for many years in composting manure with a view to reducing fly-breeding to the lowest possible minimum. The procedure now followed (which gives satisfactory results if constantly supervised) is to collect manure daily and place it in concrete pits, which are closed tightly when full to prevent the access of air and the exit of maggots. The decomposition of the manure in the sealed pits produces temperatures ranging from 30 to 53°C. [86 to 127·4°F.], which kill practically all the larvae. The pits remain closed for a minimum of 17 days, which is the maximum period occupied by the life-cycle of the flies. Unfortunately the manure, which is then made available for use, is still attractive to flies, and regulations provide that it should be spread in layers not exceeding 1 inch deep and dug in within 24 hours. An attempt is being made to render the manure less attractive by subjecting it, after 7 days in closed pits, to the action of aerobic bacteria for about 30–40 days, but so far no results of any great practical value have been obtained. The treated manure appears to be slightly less attractive to house-flies, but is still attractive to *Stomoxys*. When it has become grossly infected with white mould, it can be used with comparatively little danger of re-infestation by house-flies. To prevent fly-breeding in garbage dumps, the top and sides are covered with 6 inches of wet earth. Larvae are killed to a large extent by the high temperatures and noxious gases spontaneously developed by the decomposing material, and any larvae that make their way to the surface or adults that emerge are destroyed by a spray consisting of 8 parts crude oil, 1 part creosote and 1 part kerosene.

Larvae of *Anopheles albitarsis*, Arrib., have been found in remote parts of Gatun lake, chiefly in surface patches of bladderwort (*Utricularia mixta*). This is believed to be the northernmost point at which this dangerous malaria vector has yet been observed. In the City of Panama it has been found that collections of water in ant-guards (cangilones) round growing plants are a prolific source of breeding of certain mosquitos, particularly *Aëdes argenteus*, Poir. (*aegypti*, auct.). As these guards seldom appear effectively to prevent the access of ants to the plants, and as no serious difficulty has been experienced in raising plants in the Canal Zone where their use is prohibited, action has been taken to enforce their abolition.

FLETCHER (T. B.). **Report of the Imperial Entomologist.**—*Sci. Rep. Imp. Inst. Agric. Res. Pusa 1930–31*, pp. 87–92. Calcutta, 1932.

Mosquito control work in Pusa was continued during the season, breeding-places near the residential area being treated if necessary. *Anopheles pallidus*, Theo., and *A. hyrcanus*, Pall., both new to the locality, were found in cattle sheds during January 1931. *Stomoxys calcitrans*, L., was bred in December from larvae found in elephant's dung. Extensive myiasis in sores and wounds of cattle in the Nilgiris during the summer was found to de due to *Chrysomyia bezziana*, Villen., the eggs of which are laid near the seat of injury.

FLETCHER (T. B.) & SEN (S. K.). **A veterinary Entomology for India, Part xiv.**—*Ind. J. Vet. Sci. Anim. Husb.*, i, pt. 3, pp. 192–199, 1 pl. Calcutta, September 1931.

This part [*cf. R.A.E.*, B, xix, 112] deals generally with the bionomics of Tabanids, with a key to the Indian genera, the information being taken from the literature.

COHN (M. M.). **The Filter Moth Fly and the Flame.**—*Public Works*, lxii, no. 10, pp. 29–36, 65, October 1931. (Abstract in *Publ. Hlth. Engng. Abstracts*, xii, p. S36. Washington, D.C., 1932.)

This article describes the use of a portable, oil-burning torch for controlling *Psychoda* [*alternata*, Say], a fly that breeds in enormous numbers in sewage-filters in the United States [*cf. R.A.E.*, B, vii, 24, 90]. The torch is used to burn the flies when they congregate on the vertical walls of the concrete filter galleries.

BUCHMANN (W.). **Chironomidenschäden bei dem Belebt-Schlamm-Verfahren und ihre Verhütung und Behebung mit chemischen Mitteln.** [The Harmfulness of Chironomids in the Activated Sludge Process and its Prevention and Cure by Chemical Means.]—*Z. Gesundheitstech. u. Städtehyg.*, xxiv, nos. 1–2, pp. 31–38, 83–102, 20 figs., 20 refs. Dresden, January-February 1932.

This comprehensive paper records the results of investigations relating to the problem of the occurrence of Chironomid larvae, especially those of the group of *Chironomus thummi*, Kieff., in activated sludge plants in Germany, in which they are sometimes so numerous as to put the plant out of action in a short time. An account is given of the classification and ecology of Chironomids, their larval and pupal morphology, the eggs and the construction of the larval cases. The investigations on the effect of infestation were made in the laboratory with a model of a plant and in an actual activated sludge plant. Larvae placed in the settling tank built their cases in the activated sludge and soon made their way to the aeration tank. In a short time nearly all the flocculent sludge was taken by the larvae for making their cases and then settled in clumps. Furthermore the larvae feed on the micro-organisms normally found in activated sludge. The withdrawal in this manner of the activated sludge in the aeration and settling tanks interferes with the clearing effect of the plant.

The bionomics of these flies are dealt with very fully. Oviposition takes place at any time of day, rough, vertical surfaces being preferred. The larval stage lasts 6–7 days at 22°C. [71·6°F.], probably with 4 moults. The débris attached to the cases constitutes the food of the larvae. The pupal stage lasts 2–3 days, and the life-cycle may be completed in a fortnight. It was found that the larvae are not affected by pH values between 5 and 8·5–9, so that no modification of pH could be used to control them, because it would have to be so considerable as to interfere with the physical and chemical processes involved in clearing sewage. Pyrethrum powder was found to be quite effective without depreciating the action of activated sludge, 80 per cent. mortality of the larvae and pupae being obtained with 3 milligrams of powder to each litre of sewage. Pyrethrum also kills the larvae of *Eristalis* and *Culex pipiens*, L., which breed readily in these sewage plants. Promising results in the laboratory were obtained with finely ground derris root, and experiments with this insecticide will be continued.

JOHNSON (M. S.). **Some Observations on Chironomid Larvae and their Usefulness as Fish Food.** –*Trans. Amer. Fisheries Soc.*, lix (1929), reprint 5 pp., 1 fig., 3 refs. [New York, 1930.] [Recd. March 1932.]

In 1928 complaints were received of the annoyance caused in the vicinity of Lake Pepin by enormous numbers of *Chironomus plumosus*, L. An account is given of an investigation of the lake bottom, showing the seasonal variation in size and numbers of larvae in 1928 and 1929. In some of the samples taken during July the larvae were found at the rate of 7,000–8,000 per sq. yd. Of the five species of fish occurring in the lake that are of commercial value, four were found to contain larvae in large numbers, often to the exclusion of other food. It is reported in the literature that lakes in which the bottom fauna consists mainly of *C. plumosus* show the highest yields of fish. In the case of Lake Pepin, however, fish are very scarce despite the abundance of this food, and it is thought that this may be due to the presence of predacious species.

THEODOR (O.). **On the Structure of the Buccal Cavity, Pharynx and Spermatheca in South American** *Phlebotomus*. –*Bull. Ent. Res.*, xxiii, pt. 1, pp. 17–23, 8 figs., 7 refs. London, March 1932.

The species of *Phlebotomus* discussed include *P. intermedius*, Lutz & Neiva, from Argentina and Brazil (of which *P. mazzai*, Paterson [*R.A.E.*, B, xvi, 12] and *P. neivai*, Pinto [xiv, 210] are regarded as synonyms) and *P. migonei*, França, from Argentina. In a paper already noticed [xvii, 208] Dyar made *P. araozi*, Paterson & Shannon, a synonym of the latter, but the present author considers them to be distinct.

LEESON (H. S.). **Methods of Rearing and Maintaining large Stocks of Fleas and Mosquitos for experimental Purposes.**—*Bull. Ent. Res.*, xxiii, pt. 1, pp. 25–31, 5 figs., 4 refs. London, March 1932.

In the first part of the paper an account is given of the methods and apparatus that have been successfully used for rearing and maintaining a constant supply of fleas for experimental purposes, and for collecting eggs, larvae and adults from the breeding jar. In the second part, a cage is described that contains everything necessary for the complete development of *Aëdes argenteus*, Poir., including a tank of water for breeding, and a guineapig for the females to feed on.

HARDY (G. H.). **Notes on the** *Sarcophaga peregrina* **Group (Dipt.).**—*Bull. Ent. Res.*, xxiii, pt. 1, pp. 45–48, 9 refs. London, March 1932.

The author discusses the classification of various species of *Sarcophaga* allied to *S. peregrina*, R.-D., including *S. fuscicauda*, Bött., and *S. irrequieta*, Wlk., as well as *S. karnyi*, Hardy, from Java, *S. hutsoni*, Parker, from India and Ceylon, and *S. peregrina* from Australia. A key to the last three species is given.

So far as is known *S. peregrina* is the only species of *Sarcophaga* in Australia that breeds in human faeces; not infrequently it also infests carrion that has become tainted. Data on the length of the life-cycle, including a previous record [*R.A.E.*, B, xi, 166], show that it may occupy from 13 to 124 days, and that the number of days that the maggots remain in carrion is not necessarily related to the feeding period, which seems normally to be 3 days. Experiments on the effect of temperature on the pupae showed that there is a tendency for puparia kept at a temperature of 70°F. or lower to become divided into two sets, one producing adults early and the other considerably later. This discontinuity in sequence of emergences is believed to be normal, as it was also noticed in other species of the genus when larger numbers were bred. The minimum time spent in the puparium in these experiments was 7 days for two flies, but is normally 8 days. The maximum recorded was 79, at 70°F. It is concluded that some individuals hibernate in the puparium, whereas others deposited at the same time emerge before the winter. During the warmer periods of the year each batch of maggots deposited would complete development within a small variable limit, whereas in the winter the maximum and minimum number of days vary greatly, the greatest variation occurring in the puparium. Total life-cycles showed a variation of up to 6 days in March and nearly 40 days in June, and puparia subjected to constant temperatures showed a variation up to 3 days at 80°F. and above, 15 days at 75, 64 at 70 and 45 at 65.

HOWARD (L. O.). **The Insect Menace.**—Demy 8vo, xv+347 pp., 32 pls., text ill. New York & London, The Century Co., 1931. Price 12*s*. 6*d*. net.

The author describes the object of this interesting book as an attempt to arouse the public to an appreciation of the very real and increasing menace to humanity that exists in the insect kingdom. Pages 171–213 deal with insects as carriers of disease.

RILEY (W. A.) & JOHANNSEN (O. A.). **Medical Entomology. A Survey of Insects and allied Forms which affect the Health of Man and Animals.**—Demy 8vo, xi+476 pp., 1 pl., 184 figs. London, McGraw-Hill Pub. Co. Ltd., 1932. Price 27*s*. net.

Though this book is based on a much earlier work with a somewhat different title [*R.A.E.*, B, iii, 216], it has been largely revised and brought up to date, and in parts rewritten. The insects and other Arthropods injurious to man are considered in their systematic order, a considerable amount of space being necessarily devoted to the Diptera. The immense growth of the literature on the subject since the work appeared in its original form in 1915 is shown by the extensive and well selected bibliography, a large proportion of the papers quoted having been published since that date.

LEDENTU (—). **Les maladies transmissibles observées dans les colonies françaises et territoires sous mandat pendant l'année 1929.**—*Ann. Méd. Pharm. colon.*, xxix, no. 4, pp. 661–851. Paris, 1931. [Recd. April 1932.]

This discussion of the incidence of diseases in the French Colonies includes many that are transmitted by Arthropods. Notes are given in some cases on the research work that is being carried out.

HOFFMANN (C. C.) & VARGAS (L.). **Nuevas communicaciones acerca de la Onchocercosis de Chiapas.** [New Communications regarding Onchocercosis in Chiapas.]—*Rev. mex. Biol.*, xi, no. 5, pp. 127–147, 5 figs., 14 refs. Mexico, D.F., 1931. [Recd. April 1932.]

These observations in the Chiapas zone of Mexico, where infection with *Onchocerca caecutiens* occurs, were made in 1931 in March, the driest period of the year, whereas previous investigations there were carried out in the rainy season [*R.A.E.*, B, xix, 113, 258, etc.]. Much of the information on Simuliids is confirmatory in character. Of those concerned in the transmission of *Onchocerca*, only *Simulium avidum*, Hoffm., prefers to feed on man, the others, *S.* (*Eusimilium*) *ochraceum*, Wlk., and *S.* (*E.*) *mooseri*, Dampf, only doing so exceptionally if animals are present. The greater part of the paper deals with *Onchocerca caecutiens* in man. Another filaria found in man, also discussed, is attributed to the genus *Microfilaria*.

HOFFMANN (C. C.). **Algunas observaciones sobre el Paludismo de la zona cafetera del Soconusco (Chiapas).** [Some Observations on Malaria in the Soconusco Coffee Zone in Chiapas.]—*Rev. mex. Biol.*, xi, no. 5, pp. 155–158. Mexico, D.F., 1931. [Recd. April 1932.]

Cases of malaria were common in this district of the Chiapas region of Mexico in the wet seasons of 1929 and 1930 and in the dry season of 1931. Conditions for the breeding of Anophelines are very unfavourable, despite an average annual rainfall of 156–195 ins., because the hilly ground does not harbour stagnant water. The rains are followed by an intense drought that restricts the abundance of Bromeliaceae, the leaves of which might otherwise provide breeding-places. During the rains no larvae or adults were seen. In the dry season *Anopheles pseudopunctipennis*, Theo., and *A. albimanus*, Wied., were found in the coastal flat lands, the latter being less abundant and restricted to the coast in the brackish water belt. *A. pseudopunctipennis* breeds in the pools containing green algae left in the beds of streams that have otherwise dried up.

[Beluiĭ (Ya. M.).] **Белый (Я. М.). On the Method of preparing Paris Green and the Safety of its Application on a large scale.** [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 1, pp. 13–18, 4 figs., 1 graph, 5 refs. Moscow, 1931. [Recd. March 1932.]

Paris green was used for the control of Anopheline larvae in Dnieprostroĭ (southern Ukraine) in 1928 and 1929, when it was gradually and effectively substituted for oiling. It was mixed with fine road sand at the rate of 1 : 80 in barrels that were rolled on the ground and repeatedly turned over, and applied by means of a knapsack duster, which is described, at the rate of 1 lb. Paris green to the acre of water surface. Dusting was repeated every 12–18 days, depending on the weather, time of the year and type of the water. The advantages and drawbacks of Paris green as a larvicide are discussed [*cf. R.A.E.*, B, xiv, 17], and instances are cited in which ducks and sheep were observed to drink water that has just been treated without any harmful effect on them.

[Enikolopov (S. K.).] **Ениколопов (С. К.). An Experiment in interrupted Irrigation of Rice Plantations as a prophylactic Measure in the Control of Malaria in Daghestan.** [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 2, pp. 58–63, 6 refs. Moscow, 1931. [Recd. March 1932.]

In Daghestan, irrigated rice-fields and numerous filter pools offer very favourable conditions for the breeding of *Anopheles maculipennis*, Mg., and play a prominent part in the epidemiology of malaria, from which the whole population suffers. Experiments were, therefore, carried out in the summer of 1930 on the value of interrupted irrigation in controlling mosquitos [*cf. R.A.E.*, B, xvii, 7, 117]. As the life-cycle of *A. maculipennis* is completed in 18–20 days in Daghestan, the fields were kept under water for 13 days and then drained and kept dry for four days. After the first draining, the larvae concentrated in small puddles, and though these dried out on the third day, many of the larvae survived in moist cracks in the soil. Pupae and mature larvae were present in numbers at the time of the second draining, but all were dead on the fourth day of keeping the field dry, and only a few newly hatched larvae were present 48 hours after the subsequent flooding.

The experiments also showed that interrupted irrigation does not injure the rice and is considerably more economical as regards the amount of water used. Moreover, it is of value in the control of mosquitos of the genus *Aëdes*, which are exceedingly abundant in Daghestan and attack cattle to such an extent that in many localities rich pasture land has had to be abandoned.

[Enikolopov (S. K.).] **Ениколопов (С. К.). Contribution to the Ecology of *Anopheles bifurcatus* L. in Daghestan.** [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 2, pp. 87–89. Moscow, 1931. [Recd. March 1932.]

Details are given of the type of swamp among neglected gardens on the outskirts of the town of Makhach-Kala in which the larvae of *Anopheles bifurcatus*, L., were found breeding in 1928 [*R.A.E.*, B, xviii, 254] and in the following spring. In Daghestan this mosquito breeds exclusively in waters of subsoil origin, irrespective of whether or not they are running, the presence of trees or bushes being essential [*cf.* xvi, 173]. Larvae of all instars and pupae were present about the middle of October in narrow neglected drainage ditches with sandy banks overgrown with grasses and containing clear water with a pH of 7·47 and a temperature of 9°C. [48·2°F.]. When the temperature fell later in the month, development was retarded and no adults emerged, only the larvae of the second, third and fourth instars being present. In the laboratory the adults emerged at a constant temperature of 23–28°C. [73·4–82·4°F.]. In the course of the winter, active larvae were found at the bottom of the ditches at a temperature of 5°C. [41°F.], but none occurred in swiftly running or heavily shaded water under the canopy of dense bank vegetation. The adults first appeared between 20th and 25th April, when pupae and older larvae were also present. The pupal stage lasted 6–7 days. No adults were found in inhabited houses or cattle sheds, but they were numerous among trees and reeds adjoining the drainage ditches, and readily attacked man. As no larvae and few adults of *A. maculipennis*, Mg., occurred in the spring, *A. bifurcatus* is considered an important vector of malaria at this time of the year.

[VINTER (A. A.).] **Винтер (A. A.). Observations on the Hibernation Quarters of Mosquitos in Nizhniĭ-Novgorod.** [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 3, pp. 139–143. Moscow, 1931. (With a Summary in French.) [Recd. March 1932.]

Observations in and near the town of Nizhniĭ-Novgorod in 1928–29 showed that both *Anopheles* [*maculipennis*, Mg.] and *Culex* hibernated in cellars, barns and basements, while *Anopheles* alone occurred in poultry houses and animal quarters (though it was not found in horse stables), at temperatures varying from 3 to –32°Rmr. [39 to –40°F.]. Semi-dark quarters were preferred, followed by dark shelters, whereas those with a dispersed light were much less infested. Draughty shelters were avoided, and no mosquitos occurred in those exposed to the light. Hibernating Anophelines were more abundant in buildings close to breeding-places, but isolated individuals were found over a mile from water. The mosquitos rested chiefly on walls and cobwebs, being usually grouped in species. Where both *Anopheles* and *Culex* occurred together, the former showed a tendency to congregate near places that had to some extent access to the fresh air, whereas *Culex* preferred dark corners. With the approach of spring the resistance of the mosquitos to the fluctuations in the temperature decreased, *Culex* being more susceptible to changes than *Anopheles*. Under equal conditions of hibernation, the rate of mortality was higher in the case of *Culex*.

[KALANDADZE (L. P.).] **Каландадзе (Л. П.).** *Anopheles algeriensis* **Theob. in Georgia.** [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 4, pp. 196–197, 1 ref. Moscow, 1931. (With a Summary in French.) [Recd. March 1932.]

In the Russian Union *Anopheles algeriensis*, Theo., has only been recorded in the northern Caucasus and, doubtfully, in Turkestan [*cf.* *R.A.E.*, B, xvii, 9], apart from the finding by the author of seven females and two males in a house near Tiflis in June 1929 [xix, 127]. Brief notes are given on the characters distinguishing the adults and larvae from those of *A. bifurcatus*, L.

[Nabokov (V. A.), Bogdanova (A. A.) & Utkin (B. G.).] **Набоков (В. А.), Богданова (А. А.) и Уткин (Б. Г.). Use of Aeroplanes in the Control of the Larvae of Malaria Mosquitos.** [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 6, pp. 279–288. Moscow, 1931. (With a Summary in French.) [Recd. March 1932.]

This is a considerably fuller account than one already noticed [*R.A.E.*, B, xix, 21] of tests on dusting with Paris green from an aeroplane against the larvae of *Anopheles maculipennis*, Mg., carried out in 1929 near Moscow. Larvae of the third and fourth instars were killed more rapidly than the younger ones, which is explained by the fact that the mouth brushes of the latter are less capable of catching the particles of Paris green. In a few cases pupae were also killed, though the reason for this is not known. Laboratory investigations showed the minimum lethal dose of Paris green for the larvae to be about 0·002 mg. Paris green had no effect on the plankton, and when used at the rate of about 1 lb. to the acre of water surface was quite harmless to fish, birds or mammals. In laboratory experiments, in which larvae of *A. bifurcatus*, L., were employed, there was practically no difference in the time taken to kill them when a given amount of Paris green was applied undiluted or mixed with 5 or 20 parts talc. When, however, 50 and 100 parts talc were used, death was retarded by one and nine hours, respectively. As it is hardly practicable to apply pure Paris green, a mixture of the latter with some carrier in a proportion not exceeding 1 : 1 is recommended for aeroplane dusting.

[Popov (L. V.).] **Попов (Л. В.). A Case of Myiasis in Man caused by the Larvae of** *Wohlfahrtia magnifica.* [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 6, pp. 288–289. Moscow, 1931. (With a Summary in English.) [Recd. March 1932.]

A description is given of a case, observed in the south-west of the Ural Government in June 1930, of the infestation of the ear of a man by 20–25 larvae of *Wohlfahrtia magnifica*, Schin.

[Prosolupov (K. G.).] **Просолупов (К. Г.). Observations on Rice Fields near the Town of Armavir.** [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 7–8, pp. 357–358. Moscow, 1931. (With a Summary in French, p. 414.) [Recd. March 1932.]

Rice cultivation has only recently been started in the northern Caucasus, and the fields near Armavir are artificially irrigated. Owing to inadequate pumping plant and the porous nature of the soil, it has not been possible to keep the fields continually under water, and the plots are flooded in turns once in 24 hours and remain under water for only 2–3 hours daily. Observations in 1930 in an experimental plot that was kept constantly under water showed that the life-cycle of *Anopheles* from egg to adult is completed in 19 days. In a plot that was flooded for 12 days and then kept dry for 7, the larvae reached the second instar only, whereas in the control plot, in which the irrigation system was not changed, the eggs did not hatch. Larvae did not revive after 24 hours of draining, and a dry crust was formed on the soil on the third or fourth day. The neglected condition of the irrigation system causes, however, a gradual formation of swamps, which serve as breeding-places for Anophelines. As a result the number of primary cases of malaria in the district, which occur chiefly in August and September, has increased considerably.

The yield and quality of rice was highest in the control plot, and lowest in that kept constantly under water.

[PETRISHCHEVA (P.).] **Петрищева (П.). Epidemiology of Malaria in the Kara-kala Region of the Turkmen SSR.** [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 7–8, pp. 367–369. Moscow, 1931. [Recd. March 1932.]

In the Kara-kala region of south-western Turkmenistan, 45–80 per cent. of the population suffer from malaria in autumn, when all the three types of the disease occur, malignant tertian being predominant. Neglected irrigation systems provide important breeding-places for Anophelines, of which the species found in 1930 were *Anopheles maculipennis*, Mg., *A. sacharovi*, Favr (*elutus*, Edw.), *A. bifurcatus*, L., *A hyrcanus*, Pall., *A. pulcherrimus*, Theo., *A. plumbeus*, Steph., and *A. superpictus*, Grassi. The last named was predominant and widely distributed, being especially abundant in August and September. Observations showed that it has a great variety of breeding-places, and the adults can cover long distances, even a mountain range constituting no barrier to their migration. As soon as a mining settlement or camp is established in an uninhabited locality, *A. superpictus* congregates there in numbers near human dwellings, and should a gametocyte carrier occur among the settlers, a closed malaria focus rapidly results. As most of the Anophelines that occur in Kara-kala hibernate in the adult stage under wild conditions in the open, it is impossible to destroy them in their hibernation quarters.

[MAL'TZEV (M. V.).] **Мальцев (М. В.). Primary Causes of Malaria in Western Siberia in late Autumn and early Spring in the Light of Entomology.** [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 7–8, pp. 369–371. Moscow, 1931. [Recd. March 1932.]

On the basis of work in western Siberia since 1928, the author believes that primary cases of malaria in spring are due to the females of *Anopheles maculipennis*, Mg. (*claviger*, auct.) that enter dwellings for hibernation. Dissections showed that females in autumn do not all possess equally developed ovaries. With the first frosts at the end of August or beginning of September, mosquitos that have not matured all their eggs and still need supplementary feeding become especially active and enter houses, where they attack man and animals. Hibernation takes place in human dwellings, cellars and basements, but never in places where the temperature is so low as to cause a too prolonged state of complete inactivity. It is estimated that at some time between September and May, 30–40 per cent. of the hibernating mosquitos become active and feed. This especially occurs at the approach of spring, when females in which the fat-body is exhausted become abundant. In the insectary, females from hibernation quarters sometimes lived as long as 70 days, during which period they fed 4–6 times. The duration of their life depended directly on a sufficient amount of atmospheric humidity. An experiment carried out in an inhabited room showed that in an infected female of *A. maculipennis* oöcysts develop in 15–18 days at a temperature of 15–20°C. [59–68°F.], and with the addition of 15–20 days for the incubation period, this would explain the annual occurrence of primary cases of malaria in spring in western Siberia.

[Buduilin (V. G.) & Andreeva (V. V.).] **Будылин (В. Г.) и Андреева (В. В.). Paris Green as a Larvicide in the Control of Malaria.** [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 9, pp. 464–469, 6 refs. Moscow, 1931. (With a Summary in French.) [Recd. March 1932.]

A detailed account is given of experiments against Anopheline larvae carried out in central Azerbaijan in 1926 and 1927 with oil and Paris green, and in 1929 with Paris green only. Where the aquatic vegetation was sparse, kerosene applied at the rate of 25 gm. per square metre of water surface killed Anopheline and Culicine larvae and pupae in 2–5 minutes, as compared with 15 minutes in places with a rich growth. The kerosene usually maintained a complete film for 24–36 hours. In the intervals between treatments the water became reinfested with Culicines, but only seldom with Anophelines.

Crude oil killed the larvae and pupae of *Anopheles* and *Culex* in a few seconds or sometimes in 2–3 minutes, but after 10 days young Anopheline larvae and all the instars of those of *Culex* were present in the treated water, not only in clear spots, but also where a thin film of oil was still present.

Paris green was applied at the rate of 10 cc. to a square metre, and was mixed with sifted road dust at the rate of 1 : 100, 1 : 200 and 1 : 400. Its effectiveness was greatly decreased in the presence of plants with wide leaves floating on the surface, which should, therefore, be removed prior to the dusting. The 1 per cent. dust on water with submerged vegetation killed some of the Anopheline larvae in 15–20 minutes and all in 60–90, whereas when double the amount of carrier was used, no mortality occurred until after 60 minutes, and a number of the larvae survived. In waters in which both submerged vegetation and reeds and rushes occurred together, Paris green at the rate of 1 : 100 killed all the larvae in 50–90 minutes, whereas at 1 : 200 it caused a low rate of mortality, and at 1 : 400 was ineffective. In all experiments the treated waters became reinfested, young larvae appearing 7–10 days after the dusting. Anopheline eggs and pupae and all stages of *Culex* were unaffected. In central Azerbaijan the Anophelines develop in 14–20 days, and dusting is recommended at intervals of 14 days in May, June, October and November, and of 10 days in July-September. Dull weather, wind and rain did not decrease the effectiveness of Paris green, and it was not poisonous to animals. Its use caused a marked decrease in the numbers of the adult mosquitos found in human dwellings, and it was simpler to apply and considerably less expensive than oil.

[Fedorov (V. G.).] **Федоров (В. Г.). Observations on the Hibernation Quarters of Mosquitos in Leningrad and its Environs.** [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 9, pp. 469–474. Moscow, 1931. [Recd. March 1932.]

Observations in the years 1925–1930 in and near Leningrad showed that *Anopheles maculipennis*, Mg., and *Culex pipiens*, L., entered hibernation between mid-September and mid-October. The mosquitos concerned probably belonged to more than one generation, as females possessing a fat-body occurred as early as mid-August, and pupae were found in various breeding-places until the beginning of October. Hibernation usually took place in uninhabited buildings, basements, cellars, animal quarters, and attics of houses not more than three storeys high, at temperatures varying from 25 to –32·2°C. [77 to –26°F.], absence of draught and a certain proximity to the breeding-places (about 300 yards) being essential. Dark shelters were decidedly preferred, especially by *Culex*. The mosquitos rested on the ceiling and walls, occurring at a height of at least 32–40 ins. above the floor. In heated quarters they remained active throughout the winter. Most of them, especially the Anophelines, succumbed at temperatures of 22·5–25°C. [72·5–77°F.], whereas their power of resistance to the cold was much greater and they survived even if covered with a thick layer of hoar-frost. In some cases many mosquitos were found dead and covered with *Penicillium* sp., but it was not ascertained whether the fungus infested them before they died. It is probable that most of the hibernating females were fertilised in the autumn, as those brought into the laboratory in winter readily oviposited after being given repeated blood meals. Females of *A. maculipennis* laid 110–116 eggs at a temperature of 12–13°C. [53·6–55·4°F.] within 7–9 days after feeding, and young larvae hatched in 7–8 days. In one instance, fully developed eggs were found in engorged females of *A. maculipennis* taken in a cow-shed at 16·2°C. [about 61°F.]. A considerable percentage of the hibernating females fed readily under laboratory conditions throughout the winter, though they possessed a well developed fat-body.

The mosquitos began to leave the warmer shelters at the beginning of April. Instances were observed of the return of mosquitos to the hibernation places with a sudden drop in the temperature in spring. In the field, hibernated females lived and oviposited till mid-June, and in the laboratory till July.

[LEVENSON (E. D.).] **Левенсон (Е. Д.). Observations on the Effect of various chemical Substances on the Development of the Larvae of** *Anopheles maculipennis*. [*In Russian*.]—*Trop. Med. Vet.*, ix, no. 10, pp. 499–504. Moscow, 1931. (With a Summary in French.) [Recd. March 1932.]

In 1928, experiments were carried out near Moscow on the effect of various acids and alkalis on the larvae of *Anopheles maculipennis*, Mg., in pits in a sedge peat bog, in which untreated water had a pH of 7·3–8·1. Of the acids, only sulphuric acid gave clear results. It produced a marked reduction in the pH of the water and caused the disappearance of the larvae. After a time, however, the pH gradually rose again, owing to the neutralising action of the sedge peat. Thus sulphuric acid would be of little value in peat bogs, though it could be used in clay pits in brick works [*cf. R.A.E.*, B, xvi, 218].

In waters treated with an alkali (sodium hydroxide or caustic soda), the Anopheline larvae decreased, but a few were found all the time.

LA FACE (L.). **Sull'esistenza di razze diverse di** *Anopheles maculipennis*. [On the Existence of various Races of *A. maculipennis*.]—*Riv. Malariol.*, x, no. 6, pp. 673–683, 5 figs., 8 refs. Rome, 1931. (With Summaries in Italian, p. 801, French, p. 803, English, p. 805, German, p. 807.) [Recd. April 1932.]

As a result of work in Italy in 1927 and 1928, the author describes differences in the palmate hairs of the larvae and male genitalia of the adults of *Anopheles maculipennis*, Mg., corresponding with the three types of eggs differentiated by Falleroni, *viz.*, dark eggs (var. *messeae*, Falleroni), grey eggs (var. *labranchiae*, Falleroni), and eggs with two black cross bands [*R.A.E.*, B, xv, 71]. It would seem that there are morphological races of *A. maculipennis* that tend to predominate over each other in different regions [*cf.* xx, 58]. A race of *A. maculipennis* that is distinctly zoophilous and abundant in some regions of Italy where malaria is absent [xix, 68, 107] corresponds essentially with the race obtained from the dark eggs.

CORRADETTI (A.). **Alcune osservazioni sulla biologia dell'** *Anopheles maculipennis.* [Some Observations on the Biology of *A. maculipennis.*]—*Riv. Malariol.*, x, no. 6, pp. 689–702, 2 figs., 19 refs. Rome, 1931. (With Summaries in Italian, p. 801, French, p. 803, English, p. 805, German, p. 807.) [Recd. April 1932.]

Investigations on the minimum duration of the larval development of *Anopheles maculipennis*, Mg., were made in Italy under strictly natural conditions, and have given times rather shorter than those fixed by previous workers. As a result, the author concludes that the maximum number of generations in a year in Italy is about 10, and that the number of days between applications of Paris green should be 20 up to mid-April, 15 from mid-April to mid-May, 8 from mid-May to mid-September, and 15 subsequently. In an investigation of larval abundance at various periods of the year, a curve was obtained corresponding to that of adult abundance, with many individuals in May and June, a sharp fall in July and August, a rise in September and October, and then a gradual fall to zero in the months following. The drop in numbers in summer is not influenced by the pH or temperature of the water, the lack of food or an increase of larvicidal fish, and is only due in a minor degree to the decrease of breeding-places owing to drought. It is probable that the reason is primarily an inherent biological factor that limits the oviposition of *A. maculipennis.* This may possibly be referable to aestivation, which appears to occur, at least in a modified form, even in temperate climates.

SWELLENGREBEL (N. H.) & RODENWALDT (E.). **Die Anophelen von Niederländisch-Ostindien.** [The Anophelines of the Netherlands Indies.]—Med. 8vo, viii+ 242 pp., 44 figs., 24 maps, 24 pls. Jena, G. Fischer, 1932.

This is a third, revised and amplified edition in German of the monograph of which previous Dutch editions have been noticed [*R.A.E.*, B, vii, 19; viii, 136; ix, 216]. In the case of the more important species, particulars are given of their biology, distribution in the Netherlands Indies and relation to malaria.

SOESILO (R.). **Verspreide aanteekeningen over Anophelinen in den Oost-Indischen Archipel III.** [Miscellaneous Notes on Anopheline Mosquitos in the Netherlands Indies, III.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 6, pp. 347–351, 8 figs., 10 refs. Batavia, March 1932.

In some works on the Anophelines of the Netherlands Indies [see preceding abstract and *R.A.E.*, B, xviii, 183], *Anopheles philippinensis*, Ludl., and *A. pallidus*, Theo., are regarded as varieties of *A. fuliginosus*, Giles. The characters differentiating specifically the adults and larvae are given, some of the latter being from Iyengar's table [xvii, 113]. Attention is also drawn to differences in infectibility with malaria recorded in India [xix, 163].

Soesilo (R.). **Nogmaals Cumarinhoudende planten en Malaria.** [A further Note on Malaria and Plants containing Coumarin.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 6, pp. 379–380. Batavia, March 1932.

Consequent on Ziemann's paper on the possible protection against malaria afforded by plants containing coumarin [*R.A.E.*, B, xix, 193], an annotated list, compiled by the Director of the Herbarium at Buitenzorg, is given of such plants in the Netherlands Indies.

Quaife (W. T.). **The Brushing Method of Oiling.**—*Malayan Med. J.*, vi, pp. 62–63, 1 fig. Singapore, 1931.

This is a modification of the method of using a mop to apply oil against mosquito larvae and has been employed successfully on a number of estates in Selangor for several years. The man who sprinkles the oil on the water by means of a mop is followed by one with a flat bamboo broom, who lightly brushes the oil and water to and fro on to the edges, using the brush at a very acute angle to the sides. A fine mixture results, and an even, continuous film of oil is left on the water. For some time after treatment, there is a trickle of oil back from the edges. In the case of streams more than one yard wide, both edges should be sprinkled, but in smaller streams only the centre need be treated. In very narrow drains the brush may be drawn vigorously along the drain once without special brushing movement. A film sufficiently thick on a drain ½ yd. wide is obtained by one dip of the mop to four paces and works out at approximately 1 gal. to 220 yds., but 1 gal. to 440 yds. gives a good film that is effective as a larvicide. By this method two men can oil in 6 hours 250 acres of flat land (containing a larger number of drains than is commonly seen in an area to be oiled). The oil used is local Diesel fuel. The advantages of this method are that the work is light and rapid and about half the quantity of a cheaper oil is used, but it is not suitable for widely distributed seepages with high clay sides such as occur in some ravines. Grass is not killed by it, but it is cheaper to remove the grass by hand than to employ an expensive oil to kill it. Where a new area is to be oiled as an anti-malarial measure, the author recommends spraying heavily for a year or two and only later, when the waters are collected into a good system of open drains, economising in oil by using the brush method.

Covell (G.). **The Distribution of Anopheline Mosquitoes in India.**—*Health Bull.*, no. 17 (*Malaria Bur.*, no. 8), 39 pp. Calcutta, Govt. India Centr. Pub. Br., 1931. Price 5*d*.

In the first part of this bulletin the distribution of the Anopheline mosquitos of India and Ceylon is given under the species, which are arranged alphabetically. In the second part it is shown under districts or States grouped under sub-divisions. For details as to the exact localities in the different districts from which the various species have been recorded, together with the source of each record, the reader is referred to two papers already noticed [*R.A.E.*, B, xv, 96; xix, 216].

Boyd (J. E. M.). **Malaria in India.**—*J. R.A.M.C.*, lviii, nos. 2–4, pp. 81–91, 177–194, 248–261, 33 refs. London, February-April 1932.

The author discusses the usual anti-malarial measures used in India, and gives an account of some of the difficulties encountered in their execution as illustrated by his experience of approximately 12 years in a particular locality in the Punjab. He outlines an ideal organisation for the administration of anti-malarial work, particularly measures against mosquito larvae. Appendices include records of the distribution of Anophelines of the Lahore District, and a suggested design for a mosquito trap that has not been tested, in which the mosquitos are attracted to a light and drawn into a box through a cone with the open apex inwards by means of an electric fan placed behind the wire gauze back.

Strickland (C.) & Roy (D. N.). **The Behaviour of Plasmodia in the Mosquito after Treatment of the Human Host with Atebrin.**—*Ind. Med. Gaz.*, lxvii, no. 4, pp. 191–192. Calcutta, April 1932.

No developmental forms of *Plasmodium falciparum* were observed in 10 females of *Anopheles stephensi*, List., fed on man on the fourth and last day of a course of treatment with Atebrin and dissected 21, 23 and 24 days after feeding. On the other hand, in mosquitos fed one day and three days later and dissected 19–32 days after feeding, developmental forms were seen in 22 and 100 per cent. respectively.

Russell (P. F.). **The Control of *Anopheles minimus* Mosquito Larvae in the Philippines by Stranding and Flushing. First Report.**—*Philipp. J. Sci.*, xlvii, no. 4, pp. 439–445, 1 pl., 1 fig., 10 refs. Manila, April 1932.

The following is taken from the author's summary: An experiment is reported in which an attempt was made to control the breeding of *Anopheles minimus*, Theo., in a small stream by periodically closing and opening a dam situated about half way along its length. Quantitative observations showed that this procedure carried out twice on one day each week brought about a marked reduction in the numbers of larvae both above and below the dam, probably by stranding above and by flushing out below. It is suggested that such a simple and inexpensive method may be useful in controlling malaria in some areas in the Philippines.

Holt (R. L.) & Kintner (J. H.). **Antimosquito Sprays.**—*Philipp. J. Sci.*, xlvii, no. 4, pp. 433–438. Manila, April 1932.

Holt (R. L.). **A new Mosquito Spray.**—*Milit. Surg.*, lxix, no. 6, pp. 625–627. Washington, D.C., December 1931.

An account is given of investigations undertaken at Manila to discover a satisfactory spray for use against adult mosquitos in dwellings and especially in hospital wards. Commercial preparations were of little value, and four other mixtures tested gave mortalities of less than 30 per cent. As the effectiveness of two of these sprays appeared to be due to pyrethrum, experiments to determine a more satisfactory solvent for this material were made with carbon bisulphide, acetone and chloroform, 60 gm. pyrethrum powder being treated for 2 hours with 120 cc. solvent and the filtered extract made up to 1,000 cc. by the addition of pure kerosene. The carbon bisulphide and acetone extracts gave mortalities of 95 and 100 per cent. but were toxic to man and animals at the rate of 1 cc. to 85 cu. ft. and 1 cc. to 72 cu. ft., respectively. Moreover, there is a danger of fire with both these mixtures, and the carbon bisulphide has an objectionable odour. On the other hand, preliminary trials with the chloroform extract showed that its effectiveness approached that of the other mixtures and that it was not toxic to man at effective concentrations. It was subsequently tested in a hospital ward, where it was evenly distributed in the form of a fine mist near the ceiling at the rate of 1 cc. to approximately 26 cu. ft. Immediately after spraying, a cage containing 100 individuals of *Aëdes argenteus*, Poir. (*aegypti*, auct.) was placed on the floor near the centre of the room. In half an hour 90 of these had succumbed and 3 more were overcome during the night. No recoveries were noted in the following 24 hours. No complaints were made by patients in the ward. Several flies and cockroaches were also found dead, and later experiments showed that house ants and cockroaches were very susceptible to this spray. In other tests, the same mixture gave a mortality of 93 per cent. at a concentration of 1 cc. to 21·4 cu. ft. and of 87 per cent. at a concentration of 1 cc. to 30·8 cu. ft.

The second and apparently earlier paper gives a less detailed account of these experiments, the proportions given for the preparation of the sprays being somewhat different.

Bradley (G. H.). **On the Identification of Anopheles Mosquito Larvae in Florida.**—*Proc. Ent. Soc. Wash.*, xxxiv, no. 3, pp. 41–43, 3 refs. Washington, D.C., March 1932.

The author gives a key based on the characters used by Russell [*R.A.E.*, B, xiii, 83] and by Dyar [xvi, 167] to the larvae of Anophelines found by him in Florida, namely *Anopheles punctipennis*, Say, *A. quadrimaculatus*, Say, and two varieties of *A. crucians*, Wied. The characters of these two varieties are also briefly discussed; the adults appear to be indistinguishable.

Pomeroy (A. W. J.). **A Report on the Mosquito and Tsetse Problem at Takoradi, 1930–31.**—*Rep. Med. Dept. Gold Coast 1930–31*, pp. 101–118, 2 graphs, 3 charts, 3 maps. Accra, 1931.

An account is given of investigations on mosquitos and tsetse-flies and their control, carried out from March 1930 to February 1931 in a small locality in the Gold Coast, where *Anopheles gambiae*, Giles, is the only important malaria vector.

In experiments with cement-lined tubs filled with water either acid (pH 4), normal (pH 7–8) or alkaline (pH 10), *A. gambiae* preferred an acid or normal water, whereas *Aëdes argenteus*, Poir., showed no particular preference and appeared to develop equally well in all types. Under natural conditions *A. gambiae* was found breeding in waters with a pH varying from 4 to 8·5. When eggs were placed in waters with a pH of 9 and of 4 respectively, a larger percentage of adults emerged in two of six tests from the acid series than was obtained throughout the alkaline series, in which the emergences were consistently less than 50 per cent. With regard to salinity, *A. gambiae* was generally found in waters containing a small proportion of NaCl, but on one occasion was taken at the edge of a salt lagoon where the salinity was equivalent to 3646·5 parts per 100,000. *Aëdes argenteus* is not normally found in saline waters, but in the laboratory it has been reared in them.

The statements of workers in other parts of the world that a certain amount of direct sunlight is required for the successful breeding of *A. gambiae* have not been borne out by the observations of the author. It was found breeding in a culvert that admitted no direct sunlight at any time of the day, and experiments in shaded and unshaded cages demonstrated that it can complete its life-cycle in almost total darkness.

Glossina longipalpis, Wied., *G. palpalis*, R.-D., and *G. medicorum*, Aust., have been found in this district, the occurrence of the last-named being remarkable in that there is no typical forest vegetation less than 6 miles away. In June 1930, 20 out of 75 flies harboured *Trypanosoma vivax* in spite of the fact that there are no cattle, goats, sheep or pigs in the vicinity. Monkeys are common, and *Varanus* is fairly plentiful. The presence of *G. longipalpis* is accounted for by the prevalence of numerous small antelopes in the dense bush and thickets in this area.

Corson (J. F.). **A Note on the Susceptibility of some Birds and wild Animals to Infection with** *Trypanosoma rhodesiense*.—*J. Trop. Med. Hyg.*, xxxv, no. 8, pp. 123–124, 5 refs. London, 15th April 1932.

This paper records the results of the inoculation of *Trypanosoma rhodesiense* into various birds and wild animals in Tanganyika Territory [*cf. R.A.E.*, B, xix, 232]. Infection was tested by subinoculation of blood into white rats. Successful results were obtained in some individuals of some of the larger francolins, guinea-fowl, Muscovy ducks, native fowls, a jackal, porcupines, cane-rats and numerous hyrax (all of which last died of the disease). No infection resulted in wart-hogs, wild doves, domestic pigeons or small varieties of francolin.

Battisttini (T.). **La verrue péruvienne (sa transmission par le phlébotome).**—*Rev. sud.-amér. Méd. Chir.*, ii, no. 7, pp. 719–724. Paris, July 1931.

Observations made by the author in 1926 supported Townsend's view that verruga in Peru is transmitted by flies of the genus *Phlebotomus* [*R.A.E.*, B, xv, 159, etc.], and in 1928 experiments were undertaken by the author in collaboration with A. N. Sãinz to provide definite proof, only female sandflies being used.

On 2nd October [erroneously printed as 20th October], 23 sandflies, taken on the same day in a region where verruga was present, were introduced into a cage containing a monkey (*Macacus rhesus*). On 17th October a blood culture was negative. On 18th October the shaved abdomen of this monkey was exposed for 8 hours to the bites of 7 sandflies caught on the previous evening in the same region as before. A blood culture made on 20th October showed the presence of *Bartonella bacilliformis*. Suspensions of sandflies sown on various media in some cases yielded pure cultures of *B. bacilliformis*. A monkey inoculated on 23rd October with an emulsion of 19 sandflies showed *B. bacilliformis* in a blood culture on 5th November. Another monkey inoculated with a suspension of 15 sandflies on 4th December and with a suspension of 33 on 7th December showed *B. bacilliformis* in a blood culture on 17th December. This work has subsequently been confirmed by other investigators [xvii, 155, 189].

WENYON (C. M.). **The Transmission of Leishmania Infections. A Review.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxv, no. 5, pp. 319–348, 1 pl., 2 figs., 7 pp. refs. London, 31st March 1932.

A critical and exhaustive review is given of present knowledge regarding the transmission of leishmaniasis. In one or two cases transmission by the bites of sandflies has been effected, and there is undoubtedly a relationship between the species of *Leishmania* and *Phlebotomus* as shown by the remarkable development of the parasites in these insects. Moreover, the flagellates in the sandfly are virulent and are known to escape from the proboscis during feeding. Although the problem has not yet been completely solved, it is concluded that these facts afford overwhelming evidence that sandflies are responsible for the spread of kala-azar and oriental sore.

BAER (W. S.). **The Treatment of Chronic Osteomyelitis with the Maggot (Larva of the Blowfly).**—*J. Bone Joint Surg.*, xiii (O. S. xxix), no. 3, pp. 438–475, 56 figs. Boston, Mass., July 1931.

A brief account is given of the observations made during the War on the satisfactory condition of wounds naturally infested with blow-fly larvae that led the author, ten years later, to adopt their use in the treatment of cases of osteomyelitis. The disappearance of all flies from Baltimore about the middle of October and the consequent necessity for suspending treatment by this method, together with the fact that both gas and tetanus bacilli had been found in wounds treated with ordinary larvae, led to experiments on the rearing of sterile maggots. Owing to the presence of bacteria in the intestines of the larvae, sterilisation of their exterior was of no value, and the rearing of sterile larvae from sterilised eggs was therefore undertaken. A short account is given of the preliminary attempts, together with exact details of the technique finally adopted. The species that have been found satisfactory for this work are *Phormia regina*, Mg., *Lucilia sericata*, Mg., and *L. caesar*, L. The adults are kept in small gauze cages in an incubator and fed on honey and yeast in water. The eggs, which are laid after 4–7 days, hatch in 8–24 hours, and the larvae to be used in maintaining further generations are fed on a sterilised mixture of ground raw beef, ground raw liver and yeast. They pupate in 5–7 days in sterilised sand, and the adults emerge in 7–10 days. The eggs are removed from the cubes of fresh beef on which they are deposited, separated from one another in sterile water and subsequently immersed for 30 mins. in a solution of mercury bichloride (1 : 2,000), 25 per cent. ethyl alcohol and ½ per cent. hydrochloric acid. After being washed, the eggs are transferred to a bottle containing sterile food and placed in the incubator at 70°F. The food for maggots to be used in treatment consists of liver in a mixture of agar and yeast. On the second day after the eggs hatch, anaerobic and aerobic cultures are made of one or two larvae and of scrapings from the agar, and if these prove negative, the larvae are ready for use on the third day. The development of the larvae may be suspended for several days by placing the bottles of food containing them in an ice box at 40°F.

A detailed account is given of the application of the larvae to the wounds and the adjustment of the cage used to prevent their escape. The wound should be entirely filled with maggots so that every part may be attacked at the same time. The top of the cage should be exposed to sunlight and air, which are necessary to the well-being and activity of the maggots; as the maggots prefer shade, the sunlight causes them to penetrate more deeply into the wound. Artificial light directly over the cage may be used to effect this more rapidly. The maggots are washed out at the end of the 5th day, about which time they are ready to pupate, and further batches are inserted every 5th day until the wound heals. The action of the maggots in wounds is described. It is suggested that their action is due not only to their destroying by ingestion dead or pathological tissue, but to some biochemical substance formed during their feeding. In certain cases it is necessary to draw off the supernatant fluid formed by their activity to prevent their being drowned. When the wound reaches the state of almost healing and the bacteria become less from day to day, a stage is reached when maggots placed in the wound die after a few hours. Maggot treatment of acute osteomyelitis and tuberculous lesions and abcesses is briefly discussed. A summary is given of 89 cases treated by this method.

The author concludes that maggots are a useful adjunct to surgical treatment of chronic osteomyelitis, and are far more successful in securing permanent healing than any other method tried. They remove minute fragments of bone and tissue sloughs, and they cause the wounds to become alkaline, thus diminishing the growth of pathogenic bacteria. The general condition of the patient is better with this form of treatment; there is less absorption and less toxic reaction. In open tuberculous abcesses, with or without secondary infection, wide exposure followed by maggot treatment has proved very successful.

GOLDSTEIN (H. I.). **Maggots in the Treatment of Wound and Bone Infections.**—*J. Bone Joint Surg.*, xiii (O.S. xxix), no. 3, pp. 476–478, 6 refs. Boston, Mass., July 1931.

A brief historical review is given of the opinions of several early observers on the question of the effect of live maggots occurring in wounds [see preceding paper].

MILLER (D. F.), DOAN (C. A.) & WILSON (E. H.). **The Treatment of Osteomyelitis (Infection of Bone) with Fly Larvae.**—*Ohio J. Sci.*, xxxii, no. 1, pp. 1–9, 5 refs. Columbus, Ohio, January 1932.

The use of blow-fly maggots in the treatment of osteomyelitis has led to investigations on the rearing of bacterially sterile larvae [*cf.* *R.A.E.*, B, xx, 88], and an account is given in this paper of the results obtained at the Ohio State University. The blow-flies used were chiefly *Lucilia sericata*, Mg., and *Phormia regina*, Mg. The size and shape of cages is largely a matter of convenience. Gauze or cheese-cloth is preferred to wire screen for the cages as the flies are less easily disturbed and gauze is more easily replaced when soiled. In rooms where the temperature does not fall below 18°C. [64·4°F.] or rise above 32°C. [89·6°F.], special cabinets are not necessary. If plenty of fresh drinking water is supplied, the relative humidity of the air is not important as long as it is between 35 and 85 per cent. After tests of a variety of natural and synthetic foods, it has been concluded that if water is available the only other food required is dry granulated sugar and fresh lean meat. Dry sugar is kept in the cages at all times except when the flies are ovipositing. Meat should be given at least once in two days, and may be supplied each day if the eggs laid can be used so frequently. Occasionally the larvae leave their food-supply before they are fully developed; this may be brought about by overcrowding and by the accumulation of gases in the container used for rearing. If the vessel containing the almost mature larvae is placed in a larger container with strips of crumpled paper towelling, the migrating larvae will crawl through the paper, thus drying and cleaning themselves. They may be left there to pupate, or preferably they may be scattered on cheese-cloth in another container where they will pupate in the folds of the cloth and thus be prevented from collecting in writhing masses. The cloth is also easier to handle than soil or sand, as it may be spread out when pupation is complete and the pupae removed to petri dishes until emergence begins, when they are transferred to cages. Sex ratio is not considered to be of sufficient importance to justify the amount of labour required to count the sexes for each cage. Light and humidity exert a minor influence on oviposition, but temperature is the controlling factor. In the case of *Phormia regina* oviposition usually takes place between 20 and 34°C. [68 and 93·2°F.], the optimum temperature being near 26°C. [78·8°F.]. At lower temperatures the longevity of the flies is greatly increased, but the number of eggs laid daily is greatly decreased. The reverse is true of higher temperatures, but at temperatures near 26°C. the highest total deposition of eggs is obtained. Thus if a larger supply of maggots is necessary, egg production can be increased in two days by increasing the temperature in the cages to approximately 30°C. [86°F.] and supplying plenty of food and drinking water. Cold storage of all stages has been tried, but storage of larvae seems to be the most practical. Larvae that have fed for 24–36 hours will continue to feed after 2–3 weeks in storage. Larvae that were full-grown were stored for 4 weeks after which they pupated and 88 per cent. emerged. The temperature used was 8–10°C. [46·4–50°F.]. Longer periods of storage, varying from 6 weeks to 6 months, with a wide range of temperatures, gave a mortality too high to be of value.

For the production of sterile larvae, eggs are removed with flamed forceps from slices of fresh beef and separated from one another by gently shaking in a vial of sterile saline with glass beads. The saline is pipetted off and replaced by a solution of mercury bichloride (1:2,000) in 25 per cent. ethyl alcohol, in which the eggs are bathed for not less than 15 or more than 20 mins. After being strained and washed with saline, the eggs are placed in a sterile tube of autoclaved agar containing a small amount of meat. Some of the eggs and the tubes of young larvae are tested for at least three days for aerobic and anaerobic bacteria before they are released for use in clinical practice.

LIVINGSTON (S. K.) & PRINCE (L. H.). **The Treatment of Chronic Osteomyelitis with special Reference to the Use of the Maggot Active Principle.**—*J. Amer. Med. Ass.*, xcviii, no. 14, pp. 1143–1149, 10 figs., 10 refs. Chicago, Ill., 2nd April 1932.

The history of observations on the action of live maggots in suppurating wounds is briefly reviewed. They were first used scientifically as living antiseptics in the treatment of chronic pyogenic and tuberculous osteomyelitis by the late Dr. W. S. Baer. In the early days of this work one of the authors worked with Dr. Baer. The technique eventually adopted for rearing the maggots is briefly reviewed, the fly being *Calliphora erythrocephala*, Mg. It was found that the maggots employed for the first, second, and third applications lived until replaced, but that those used subsequently lived for a decreasing amount of time until, after the fifth application, they lived only a few hours. Death is due to an increase in the pH of the wound and to the production of some substance through the contact of the live maggots with the tissues which so increases in virulence that in time the maggots are killed by it. This substance, which is called a therapeutic active principle, has been shown by animal experiments to be in itself a curative agent. Moreover, cultures of pyogenic organisms were killed by contact with filtered, uncontaminated products derived from the bodies of larvae. It was at first thought to be a bacteriophage, but further experiments indicate that it is a substance not affected by sterilisation.

The active principle is obtained by grinding live maggots in sterile saline solution and filtering the product through coarse and fine Berkefeld filters. Sterility is tested aerobically and anaerobically before use. A vaccine is also made, consisting of an autogenous or polyvalent suspension of killed organisms counted and fortified by the active principle and tested for sterility.

The authors discuss 100 cases of chronic osteomyelitis, infected wounds and compound fractures that have been treated with this active principle and vaccine, either with or without previous treatment with live maggots; 88 per cent. of the cases healed. Chronic leg ulcers, sinus infections and mastoid infections are now being treated with the active principle and vaccine. Three cases of long-standing middle ear disease have been healed.

Wilson (E. H.), Doan (C. A.) & Miller (D. F.). **The Baer Maggot Treatment of Osteomyelitis. Preliminary Report of Twenty-six Cases.**—*J. Amer. Med. Ass.*, xcviii, no. 14, pp. 1149–1152, 6 refs. Chicago, Ill., 2nd April 1932.

After reviewing various methods of treatment for osteomyelitis, the authors describe Dr. Baer's method in which living maggots are used, and discuss 26 unselected cases treated by this method, in 22 of which successful results were obtained. The wounds were re-dressed every 3–5 days according to the period for which the larvae survived. As the larvae reach maturity, they wander out of the wound, and their appearance in any numbers outside the dressing is an indication that they are about to pupate. They are washed out of the wound at the end of each treatment, a clean, dry dressing is applied, and the patient is given a rest of 24 hours before the next application of larvae. Very young larvae failed to survive the change of environment when placed in a fresh wound, and larvae 72 hours old were found to be most satisfactory. The age of the larvae becomes of less importance after several implantations in a given case. This may be due to the gradual increase in alkalinity within the wound since it has been shown that larvae thrive best in an alkaline medium; they will not live in the presence of excessive acid secretions. Irrigation of wounds with a mildly alkaline solution just before implantation enabled the larvae to maintain themselves. The use of large numbers of larvae is recommended in the early stages when necrotic tissue is plentiful, but in the later stages overcrowding may cause the larvae to leave their food before they are fully developed. Free drainage is important, as an accumulation of pus may lead to the drowning of the maggots.

The main factors involved in bringing about healing by this method are probably the scavenger activity of the maggots in removing devitalised tissue favourable for bacterial growth, and the production of an increasingly alkaline reaction in the wound. It has been proved that there is no demonstrable bacteriophage present in the larvae that would account for their favourable action, but studies are now in progress to determine the possibility of the involvement of an additional factor or factors that contribute to the healing process.

SYMES (C. B.) & HOPKINS (G. H. E.). **Notes on Fleas of Rats and other Hosts in Kenya.**—*Rec. Med. Res. Lab. Kenya*, no. 1, 57 pp., 3 fldg. charts, 11 refs.

SYMES (C. B.). **Notes on Rats, Fleas and Plague in Kenya (II).**—*Op. cit.*, no. 3, 28 pp., 3 charts. Nairobi, January 1932.

In the first paper the results of rat and flea surveys carried out in various districts of Kenya up to the end of 1928 are analysed. The following is taken largely from the authors' summary : The influence of the sources from which house-rats are obtained on the presence of a particular species of flea has been shown to be of importance in the estimation of flea populations and seasonal fluctuations. Generally a predominance of *Xenopsylla cheopis*, Roths., is associated with buildings of a permanent and semi-permanent type, whereas *X. brasiliensis*, Baker, the indigenous rat flea, is most abundant in native huts and buildings of the mud and thatch type. There is evidence that *X. brasiliensis* leaves a dead rat in a "nipper" trap more rapidly than the majority of *X. cheopis*, and such traps are therefore useless in flea survey work. *X. cheopis* generally appears to be distinctly more numerous on *Mus rattus* than on the indigenous multi-mammate rat, *Mus coucha*. Fluctuations appear to occur in the numbers of certain species of fleas over long periods. Thus in Mombasa, *X. cheopis* appeared to be much more numerous than *X. brasiliensis* up to 1927, whereas in 1928 the latter was more than twice as abundant as the former. A similar change occurred in Machakos. *X. cheopis* was the predominant flea of *M. rattus* in Nairobi and the Nakuru district, whereas *X. brasiliensis* was the prevalent species in Kisumu and in Kisii and South Kavirondo. *X. cheopis* was common on field rats, particularly *Arvicanthis abyssinicus*, in the Nakuru farming district, whereas *X. brasiliensis* was very scarce. The climate of Mombasa is probably suitable for the transmission of plague by *X. cheopis* in nearly all months of the year, but that of Machakos and Nairobi only from January to March or April. There is circumstantial evidence associating *X. brasiliensis* with outbreaks of plague in Mombasa and South Kavirondo. *A. abyssinicus* is suspected of carrying plague in the Nakuru district, where it is not only the commonest rodent but harbours the largest number of fleas, including large numbers of *X. cheopis* and *Dinopsylla lypusus*, J. & R. The host preferences of various species of fleas are shown.

In the second paper an analysis is made of the rats and fleas caught in Mombasa, the Nairobi district and Kisii during the period from January 1929 to May 1930. The following is taken largely from the author's summary : Notes are given on the breeding seasons of *M. rattus*, *A. abyssinicus* and *M. coucha* and on the breeding habits of their fleas. The fleas of *M. rattus* are chiefly *X. cheopis* and *X. brasiliensis*, with small numbers of *Dinopsylla lypusus*, *Echidnophaga gallinacea*, Westw., and *Leptopsylla segnis*, Schönh. In towns such as Nairobi and Mombasa, *X. cheopis* was again found to be the predominant flea on rats caught in the more permanent types of buildings. *X. brasiliensis* is the most numerous species of *Xenopsylla* on *M. rattus* in the native reserve and estate areas and in the Kisii township area. It is probable that the spread of *X. cheopis* follows to a great extent permanent lines of communication. *Dinopsylla lypusus* is the predominant flea on the three commoner field rats in Nairobi and in their nests, being particularly numerous on *M. coucha*. *X. cheopis* also occurs in small numbers. *X. brasiliensis* appears to have been present only on those rats caught in the native reserve or on estates. *Ctenophthalmus cabirus*, J. & R., occurs in appreciable numbers on field rats and in their nests. Large numbers of *X. cheopis* were recorded from two individuals of a species of *Tachyoryctes* and their nests. There appears to be little doubt that both *X. cheopis* and *X. brasiliensis* are factors in plague transmission in Kenya, and that *D. lypusus* is also concerned. *X. brasiliensis* appears to be the main vector on house rats in some native reserve areas, but is also closely associated with the disease, together with *X. cheopis*, in townships.

[IOFF (I. G.) & TIFLOV (V. E.).] **Иофф (И. Г.) и Тифлов (В. Е.). Contribution to the Fauna and Ecology of the Fleas of the Forest-Steppe Zone.** [*In Russian.*]—*Mag. Paras. Mus. zool. Acad. Sci. URSS.*, i, pp. 193–227, 12 figs., 11 refs. Leningrad [? 1930]. (With a Summary in German.) [Recd. March 1932.]

In continuation of previous investigations in the Saratov Government [*R.A.E.*, B, xvi, 222], further collections of fleas were made in 1927 and 1928 in districts in which the steppe adjoined deciduous or pine forests. The 29 species recorded include *Ctenophthalmus golovi*, sp. n., which was found in nests of unidentified rodents. Notes are given on the local distribution, ecology and hosts of 25 species. The occurrence of *Xenopsylla cheopis*, Roths., which is the chief transmitter of plague from rat to man and was only found in one house in the town of Saratov, on rats and mice, is of special interest. Variations in the characters of the male of *Ceratophyllus fasciatus*, Bosc, are discussed, and the morphological characters of both sexes of *Ctenophthalmus orientalis*, Wagn., are described in detail. A section of the paper deals with the distribution of the various species of fleas in nests of field and forest mice, and with the relation existing between the fleas on various hosts and the type of country, showing that *C. orientalis* and *Ceratophyllus consimilis*, Wagn., are confined to the steppe, *Ctenophthalmus wagneri*, Tiflov, and *C. assimilis*, Tasch., occur in localities adjoining forests, and *C. agyrtes eurous*, J. & R., *Ceratophyllus mustelae*, Wagn., and *Ctenopsylla taschenbergi*, Wagn., are chiefly found in forests.

MOOSER (H.), CASTANEDA (M. R.) & ZINSSER (H.). **The Transmission of the Virus of Mexican Typhus from Rat to Rat by *Polyplax spinulosus*.**—*J. Exptl. Med.*, liv, no. 4, pp. 567–575, 5 refs. New York, 1st October 1931.

Previous investigations have shown that the rat is a reservoir of Mexican typhus and probably the most important means by which the infection is maintained during inter-epidemic periods [*R.A.E.*, B, xx, 50]. During epidemic periods, the authors consider that *Pediculus humanus*, L., is the important agent in the transmission of the disease from man to man. Surveys of the ectoparasites of rats were undertaken to determine the method of transmission from rat to man and particularly from rat to rat. Examination of about 100 wild rats yielded 91 *Xenopsylla cheopis*, Roths., 11 *Ceratophyllus fasciatus*, Bosc, 13 *Leptopsylla segnis*, Schönh. (*musculi*, Dug.), 1 *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., numerous mites, *Echinolaelaps* (*Laelaps*) *echidninus*, Berl., on several rats, and the louse, *Polyplax spinulosa*, Burm., which was numerous on many rats. The distribution of fleas and mites on the rats was very irregular. *P. spinulosa* was found on most individuals of *Mus rattus*, but its distribution on *M. norvegicus* (*decumanus*) was extraordinarily irregular ; it was, however, the most frequent and the most numerous parasite of the rats.

The ectoparasites were examined, and suspensions of the several species were inoculated intraperitoneally into male guineapigs. Negative results were obtained in each case. One of the guineapigs inoculated with lice showed a febrile reaction suggestive of typhus, but no scrotal swelling, and subinoculations were negative.

Examination of lice removed from a rat (previously injected with benzol to increase its susceptibility) on the 12th day after its inoculation with *Rickettsia prowazeki* originating from a strain of Mexican typhus showed numerous micro-organisms exhibiting the polar staining and morphology of *R. prowazeki* in all of them. Injection of such lice into guineapigs produced the disease. In a similar experiment using a rat not previously benzolised, rickettsiae were only found in some of the lice. This rat was killed and lice that were leaving it placed on a normal rat. No fever was noticed in the second rat, but a Weil-Felix reaction was positive, and inoculation of its brain into a guineapig produced the infection. Some of the lice from this rat contained rickettsiae, and a guineapig inoculated with 12 contracted the disease.

The jar in which the inoculated rats were kept contained a large number of *Echinolaelaps echidninus*, but subsequent examination of some of the mites showed no rickettsiae, and two guineapigs inoculated with an emulsion of 20 individuals that had had the opportunity of feeding on three infected rats in succession for 26 days did not become infected.

Individuals of *Ornithodorus turicata*, Dug., fed on infected rats were inoculated after an interval into guineapigs, and infection was produced after two days but not after nine. This is explained by the survival of the typhus virus for two days in the relatively large amount of blood ingested by the tick.

It is concluded that *P. spinulosa* is the ectoparasite most likely to be responsible for maintaining typhus among rats in the city of Mexico, although, as it does not feed on man, it can be of no importance in transmitting the disease to human beings. The rickettsiae in its gut show the same prolific multiplication as is seen in *Pediculus humanus*. It is believed that *R. prowazeki* multiplies within the epithelial cells of the gut, destroying its entire lining and leading eventually to the death of the vector.

As the incubation period of Mexican typhus in guineapigs is closely related to the amount of virus inoculated, it is concluded from a comparison of the incubation periods of the two guineapigs inoculated with lice and a rat's brain respectively that the 12 lice contained more virus than the brain of the rat on which they had fed.

Whether *Polyplax spinulosa* transmits the infection by biting, by depositing faeces on abrasions of the skin or by infection of the mucous membrane of the mouth after being ingested by the rat has not been investigated. The negative results obtained with fleas are not regarded as important in view of the positive results of other workers [xix, 93, etc.], and these ectoparasites are regarded as the most likely vectors from rat to man, although the problem is not yet settled in view of the work with ticks and *Cimex lectularius*, L. [xix, 116 ; xx, 24], and the brief survival of the infection in many insects.

PAPERS NOTICED BY TITLE ONLY.

[BEKLEMISHEV (V.), BRYUKHANOVA (A.) & SHIPITZUINA (N.).] **Беклемишев (В.), Брюханова (А.) и Шипицына (Н.). The Epidemiology and Prophylaxis of Malaria in Magnitogorsk.** [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 7–8, pp. 349–350. Moscow, 1931. (With a Summary in French, p. 413.) [Recd. March 1932.] [*Cf. R.A.E.*, B, xx, 90.]

[NABOKOV (V. A.).] **Набоков (В. А.). The Use of Aeroplanes in the Control of Mosquito Larvae.** [*In Russian.*]—*Trop. Med. Vet.*, ix, no. 7–8, pp. 395–397. Moscow, 1931. (With a Summary in French, p. 416) [Recd. March 1932.] [*Cf. R.A.E.*, B, xx, 116.]

Catalogue of Literature on injurious Insects in U.S.S.R. in 1925–1928. [*In Russian:* Agricultural and forest Pests 1661 titles; medical and veterinary Entomology 856 titles.]—[*Pub.*] *Lenin Acad. Agric. Sci. U.S.S.R., Inst. Plant Prot.*, no. 20, 95 pp. Leningrad, 1931. Price 1 *rub.* 50 *kop.* [Recd. May 1932.]

GERRY (B. I.). **Morphological Studies of the Female Genitalia of Cuban Mosquitoes.**—*Ann. Ent. Soc. Amer.*, xxv, no. 1, pp. 31–64, 6 pls., 73 refs. Columbus, Ohio, March 1932.

LEWIS (D. J.). **The Mosquitoes of Wicken Fen.**—*Nat. Hist. Wicken Fen*, pt. vi, pp. 548–559, 1 pl., 10 refs. Cambridge, March 1932.

TATE (P.). **The larval Instars of *Orthopodomyia pulchripalpis* Rond. (Diptera Nematocera).**—*Parasitology*, xxiv, no. 1, pp. 111–120, 2 pls., 1 fig., 12 refs. Cambridge, 24th March 1932.

DE LA CAMARA (P.). **Leishmaniosis y *Phlebotomus*.**—*Med. Países calidos*, v, no. 2, pp. 81–123, 8 figs., 150 refs. Madrid, March 1932. [A survey of the literature.]

KRÖBER (O.). **Neue südamerikanische Tabaniden des ungarischen National-Museums und einiger anderer Institute.** [New S. American Tabanids from the Hungarian National Museum and other Institutions.]—*Ann. hist.-nat. Mus. hung.*, xxvii (1930–31), pp. 329–350, 19 figs. Budapest, 1931. [Recd. April 1932.]

JORDAN (K.). **Die aus der arktischen Zone bekannten Flöhe.** [Known Fleas of the Arctic Zone.]—*Fauna arctica*, vi, no. 2, pp. 116–118. Jena, 15th March 1932.

BAGNALL (R. S.). **The Anoplura (Sucking Lice) of Northumberland and Durham (Supplement).**—*Vasculum*, xviii, no. 2, p. 45. Newcastle-upon-Tyne, May 1932. [*Cf. R.A.E.*, B, xviii, 200.]

POOL (W. A.). **The Etiology of "Louping-ill." A Review of the Literature.**—*Vet. J.*, lxxxvii, pp. 177–200, 222–239, 2 pp. refs. London, 1931. [*Cf. R.A.E.*, B, xix, 92.]

MARCANDIER (M.) & PIROT (R.). **Etude sur les ectoparasites des rats de Toulon.**—*Bull. Soc. Path. exot.*, xxv, no. 3, pp. 237–244, 3 refs. Paris, 1932.

Details are given of the ectoparasites found on 285 rats captured on warships at Toulon and on 99 captured at various places in the town. On board ship 65·6 per cent. were *Mus rattus*, whereas on land only *M. norvegicus* (*decumanus*) was taken. With the exception of the finding in single instances of *Pulex irritans*, L., *Leptopsylla segnis*, Schönh. (*musculi*, Dug.) and *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., the parasites observed on the ship rats were the same as those already noticed [*R.A.E.*, B, xx, 49]. A total of 14 individuals of *Xenopsylla cheopis*, Roths., taken on five rats (*M. decumanus*) were found to harbour *Protospiroptera muris*. These worms were also observed in the stomach of one of the five rats, in which tumours occurred in the stomach and liver. From a study of the seasonal incidence of *X. cheopis* it is concluded that the warm weather favours its multiplication, but the effect is delayed, and in a similar way, several months of cold weather and low temperature are necessary to reduce its numbers to a minimum.

The ectoparasites on the town rats were of the same species with the addition of *Laelaps nuttalli*, Hirst, and *Echinolaelaps* (*L.*) *echidninus*, Berl., which were of localised distribution. The proportions of the parasites were, however, different, particularly in the case of the fleas. Under conditions on board ship *X. cheopis* predominates, but on land the climate is less favourable and *Ceratophyllus fasciatus*, Bosc, takes its place except in certain very localised zones. The higher proportions of *Leptopsylla segnis* and *Ctenocephalides canis* are probably due to the increased facilities on land for the contact of rats with mice and dogs. The uniform distribution of the parasites of rats on board ship is in direct contrast with conditions on land where the same parasites are found in proportions that vary according to the locality in which the rats are captured.

TOUMANOFF (C.) & FARINAUD (E.). **Note sur une prospection entomologique à Chapa. Présence de deux espèces anophéliennes jusqu'ici méconnues en Indochine :** *A. lindesaii* **Giles et** *A. gigas* **var.** *baileyi* **Edw.**—*Bull. Soc. Path. exot.*, xxv, no. 3, pp. 245–247, 1 ref. Paris, 1932.

An Anopheline survey was carried out in August (the middle of the rainy season) in a locality of Tonkin situated at an altitude between 4,600 and 5,250 feet. Of 675 larvae collected, 140 were reared to the adult stage. They comprised the following species: *Anopheles aitkeni*, James, *A. barbirostris*, Wulp, *A. hyrcanus* var. *sinensis*, Wied., *A. maculatus*, Theo., *A. karwari*, James, *A. fuliginosus*, Giles, *A. vagus*; Dön., *A. lindesayi*, Giles, and *A. gigas* var. *baileyi*, Edw., the last two being recorded for the first time from Indo-China. *A. maculatus* is the most prevalent species in August, followed by *A. lindesayi* and then by *A. hyrcanus* var. *sinensis*. *A. minimus*, Theo., and *A. jeyporiensis*, James, the important vectors of malaria in other regions of Tonkin, and *A. aconitus*, Dön., were not found, and it is suggested that possibly Anophelines of this group do not occur above a certain altitude. In two collections made in houses, only single females of *A. maculatus* and *A. hyrcanus* var. *sinensis* and two males of *A. vagus* were obtained.

KRIJGSMAN (B. J.) & WINDRED (G. L.). **Physiologisch-oecologische onderzoekingen over *Lyperosia exigua*. Deel I: De relatie tusschen de volwassen *Lyperosia* en zoogdierfaeces.** [Physiological and ecological Investigations on *L. exigua*. Part I: The Relation between Adults of *Lyperosia* and the Faeces of Mammals.]—*Ned.-Ind. Bl. Diergeneesk.*, xliii, no. 2, pp. 113–131, 2 figs., 17 refs. Batavia, 1931. (With Summaries in German and English.) [Recd. April 1932.]

Experiments at Buitenzorg showed that adults of *Lyperosia exigua*, de Meij., are attracted by smell to, and feed on, the dung of buffalos, cattle and horses in that order of preference, dog droppings being unattractive. The attraction decreases with the age of the dung. Though eggs are usually laid on dung, they are also deposited in other places, so that oviposition must be largely a response to internal stimuli.

ABBOTT (C. E.). **The Proboscis Response of Insects, with special Reference to Blowflies.**—*Ann. Ent. Soc. Amer.*, xxv, no. 1, pp. 241–244, 8 refs. Columbus, Ohio, March 1932.

The following is taken from the author's summary: The proboscis response, which is a characteristic reaction of haustellate insects, is initiated by one or more stimuli, the more important of which are chemical. The perception of chemicals is olfactory. In Diptera the nervous mechanism of this response is complete in the head, but this does not preclude the possibility that the sensory part of the mechanism exists elsewhere. The sensory elements involved are not exclusively antennal.

YOUNG (W. J.). **The Sheep Maggot Fly.**—*Vet. J.*, lxxxviii, no. 4, pp. 138–140. London, April 1932.

Lucilia sericata, Mg., is the chief blow-fly attacking sheep in England, infestation by *Calliphora erythrocephala*, Mg., and *C. vomitoria*, L., being comparatively rare. Sheep may be attacked from the first week in April to the third week in November, but May and June are considered to be the months when the fly is most prevalent. Notes are given on its life-history; under the most favourable conditions the life-cycle may be completed in 25–31 days. The causes and symptoms of attack are discussed, with general notes on preventive and remedial measures, including a reference to the control of blow-flies in South Africa [*R.A.E.*, B, xx, 37].

JOHNSTONE (R. N.). **Sheep Dipping. Requirements of the Act.**—*J. Dept. Agric. Victoria*, xxx, pt. 2, pp. 77–80, 2 figs., 4 diags. Melbourne, February 1932.

Brief notes are given on the bionomics of the sheep "tick" [*Melophagus ovinus*, L.] and the sheep louse [*Bovicola* (*Trichodectes*) *ovis*, L.] [*cf.* *R.A.E.*, B, xviii, 86]. The Sheep Dipping Act is explained, and diagrams of dipping pens and bath are given, with short instructions for dipping.

Henry (M.) and others. **The Control of Ked (Tick) in Sheep.**—*Sci. Bull. Dept. Agric. N.S.W.*, no. 38, 28 pp., 3 refs. Sydney, November 1931. [Recd. April 1932.]

Accounts are given of the dipping of sheep for the control of *Melophagus ovinus*, L., in various districts in New South Wales, with notes on the probable reasons of reinfestation, which in general is due not so much to the ineffectiveness of the dips as to the methods adopted. Experiments were undertaken in 1929 on the effect on the insect of exposure to frost (which is of frequent occurrence on the Northern Tablelands, where difficulty is experienced in keeping the sheep free from infestation), since it was thought that it might live away from its host for a long time where cold, moist conditions exist [*cf. R.A.E.*, B, vi, 42 ; vii, 120]. During a period when the maximum shade temperature was 59°F. and the minimum 18, adult flies out of doors died in one night when exposed and in 3 or less when under various kinds of cover, whereas those indoors died in 6. Pupae kept under similar conditions for 3 months all failed to give rise to adults. The longer survival of the insect obtained in previous experiments [*loc. cit.*] is explained by the fact that relatively constant temperatures were used.

Dinulescu (G.). **Recherches sur la biologie des Gastrophiles. Anatomie, physiologie, cycle évolutif.**—*Ann. Sci. nat.*, (10) xv, Zool., no. 1, pp. 1–183, 8 pls., 43 figs., 9 pp. refs. Paris, March 1932.

This paper deals with *Gastrophilus intestinalis*, DeG., *G. haemorrhoidalis*, L., *G. nasalis*, L., *G. pecorum*, F., *G. inermis*, Br., *G. meridionalis*, Pill. & Evans, and *G. nasalis* var. *nudicollis*, n., the last two of which are known only as larvae, and records the results of work carried out in Rumania and Paris. Keys are given to the adults and larvae, with full details of the external and internal anatomy, physiology and development, and biology, including oviposition and migration of the larvae within the host. All the species dealt with, of which *G. intestinalis*, *G. haemorrhoidalis* and *G. nasalis* appear to be cosmopolitan, normally attack equines, the eggs being laid by the various species on different parts the host. *G. inermis*, *G. haemorrhoidalis* and *G. nasalis*, which oviposit near the mouth, lay fewer eggs than *G. intestinalis*, which oviposits on the chest, legs and abdomen, or *G. pecorum*, which lays large numbers of eggs on the hoofs of the host and on inanimate objects near. The eggs of *G. meridionalis*, which occurs in South Africa on zebras and in Spain on horses [*R.A.E.*, B, xx, 86], are laid during the hot season on the coat of the host and either hatch spontaneously or await introduction into the mouth by the host itself. Incubation of the eggs of species of *Gastrophilus* lasts 5–6 days. Hatching is spontaneous in the case of eggs laid near the mouth, the others require rubbing by the host before they can hatch. For the survival of the primary larvae humidity, supplied naturally by the saliva of the host, and a temperature of 37–38°C. [97·6–100·4°F.] are necessary.

Pettit (R. H.). **Methods to reduce Losses caused by Ox Bot.**—*Quart. Bull. Michigan Agric. Expt. Sta.*, xiv, no. 3, pp. 190–191. East Lansing, Mich., February 1932.

Brief notes are given on the importance and bionomics of *Hypoderma* in Michigan, and on a method for treating cattle infested with the flies with a proprietary derris ointment. This should be applied late in February or March, after the larvae have attained sufficient size to be easily found by rubbing the hand over the back of the animal, and before any of them have emerged for pupation. The scab over the opening in the skin should be removed, and a small quantity of the ointment rubbed in. A second application may be necessary in March and another in April, since the larvae do not all develop at the same time.

REES (C. W.). **The experimental Transmission of Anaplasmosis by** *Dermacentor variabilis.*—*Science*, lxxv, no. 1942, pp. 318–320, 1 ref. New York, 18th March 1932.

Experiments in Louisiana with *Dermacentor variabilis*, Say, from cattle in Mississippi and Florida, showed this tick to be a further vector [*cf. R.A.E.*, B, xix, 66] of anaplasmosis of cattle. It is not known to be present in the Rocky Mountain States, but occurs on the Pacific coast and has a wide distribution east of a line extending south from the middle of the Canadian border of North Dakota to the coast of Texas, so that it may carry anaplasmosis into many areas hitherto considered to be outside the enzootic range of the latter. The disease was transmitted to susceptible animals by nymphs that had engorged as larvae on clinical cases, and also by adults that had engorged as nymphs on a convalescent case, but not by larvae that were the offspring of ticks engorged as adults on a clinical case. These results and the recent incrimination of *D. variabilis* in the transmission of a disease resembling Rocky Mountain spotted fever [*R.A.E.*, B, xix, 195] indicate the need for further research on the tick as one of major importance from both a medical and a veterinary aspect.

SMITH (J. M.). **Piroplasmosis and Anaplasmosis in Cattle, Sheep and Goats.**—*Rep. Palestine Dept. Agric. For. 1927–30*, pp. 16–17.
BODKIN (G. E.). **Entomological Service.**—*Op. cit.*, pp. 48–55. Jerusalem, 1931. [Recd. March 1932.]

Cattle, sheep and goats in Palestine are all affected by anaplasmosis due to *Anaplasma marginale* and by piroplasmosis, which, in cattle, is caused by *Babesiella* (*Babesia*) *bovis*, *Piroplasma* (*B.*) *bigeminum*, and *Theileria annulata*. The following ticks have been collected in Palestine: *Boophilus annulatus*, Say, *Hyalomma aegyptium*, L., and *Rhipicephalus sanguineus*, Latr., on cattle, camel, dog, donkey, goat, horse, mule and sheep; *R. bursa*, C. & F., on camel, cattle, goat, mule and sheep; *Argas persicus*, Oken, on fowls; *Hyalomma syriacum*, Koch, on tortoise; *Haemaphysalis leachi*, Aud., on hedgehog; *H. cinnabarina punctata*, C. & F., on goat, cattle, sheep and dog; *Boophilus annulatus calcaratus*, Bir., on cattle; *Ixodes ricinus*, L., on goat, camel and sheep; *Ornithodorous lahorensis*, Neum., on sheep, cattle and goat; *O. savignyi*, Aud., on camel; and *Amblyomma lepidum*, Dön., on cattle. Infected ticks are widely distributed throughout the country, rendering all districts equally unsuitable for stock raising. Heavy infestation corresponds with wooded localities showing abundant undergrowth, swamps and zones of relatively heavy rainfall.

In the absence of any satisfactory remedy for tick-borne diseases, compulsory, regular and systematic dipping of stock in an approved dipping fluid at stated intervals under Government control and supervision is recommended as essential to the development of the livestock industry. The destruction of ticks by spraying with a solution of cattle-dip has been demonstrated on various farms. Details are given of the erection of private dipping tanks in certain localities, but the necessity of the erection of public tanks throughout the country with Government assistance is insisted upon, although the scheme has hitherto been considered financially impracticable.

G. E. Bodkin reports that *Argas persicus*, Oken (*miniatus* Koch) is widespread in Palestine and is the vector of spirochaetosis of poultry. Fumigation of fowl houses with hydrocyanic acid gas under the tents used for *Citrus* proved quite ineffective in controlling the ticks.

CARPANO (M.). **On the principal Types of Piroplasm observed in Bovines in Egypt.**—*Bull. Minist. Agric.* [*Egypt*], no. 116, 20 pp., 7 pls. Cairo, 1932.

The author discusses and describes the species of Haemosporidia that occur in cattle in Egypt, as a preliminary to investigations on their vectors. They comprise *Piroplasma bigeminum* (*bigeminum bovis*), *Babesiella bovis*, *Theileria* (*Gonderia*) *mutans*, *Theileria annulata* (Mediterranean Coast fever) and *Anaplasma marginale*.

COWDRY (E. V.) & HAM (A. W.). **Studies on East Coast Fever. I. The Life Cycle of the Parasite in Ticks.**—*Parasitology*, xxiv, no. 1, pp. 1–49, 7 pls., 1 fig., 32 refs. Cambridge, 24th March 1932.

A detailed account is given of work carried out in Kenya Colony on the life-cycle of *Theileria parva*, the causal organism of African Coast fever of cattle, in *Rhipicephalus appendiculatus*, Neum., the vector of the disease, a preliminary account of which has already been noticed [*R.A.E.*, B, xix, 35].

The following is largely taken from the authors' summary: Approximately accurate information on the survival of ingested parasites can only be secured from sections, and of 290 ticks examined in very complete serial sections, parasites were found in 60·1 per cent. In the first series of infected nymphs [*loc. cit.*], 66 per cent. of those containing parasites were males. In the erythrocytes of animals infected with African Coast fever on which the ticks engorged, large and small parasites were distinguishable and both showed signs of division. Intra-erythrocytic parasites were observed in the gut of the ticks only up to the 6th day after engorgement. The liberation of the parasites takes place at a different rate in different ticks. They were seen free in the lumen of the gut from the time of engorgement up to 8–14 days after. Both large and small parasites tend to accumulate on the surfaces of the epithelial cells lining the gut, where fertilisation probably takes place (although no convincing evidence of this was discovered). Many parasites are taken up by epithelial cells that stretch further into the lumen than their neighbours and are called "pedunculated," but it is the parasites that enter the non-pedunculated epithelial cells that carry on the life-cycle. They enter in smaller numbers and more slowly, their appearance in these cells being recorded 7 days after they were first noted in the pedunculated cells. They remain there for as long as 16–25 days. The small forms soon disappear, but the large forms are at first present in considerable numbers and give rise to a stage without distinct nuclei, which is referred to as the "zygote." The zygotes that survive the digestive action of the cell increase in size, and about 18 days after engorgement and approximately at the time of moulting of the tick they begin to exhibit nuclei. Oökinetes, which develop rapidly within the zygotes, escape, by rupturing the distended limiting membrane, into the cytoplasm of the epithelial cells lining the gut and thence into the body cavity, where they may be found in close association with the salivary glands. The oökinetes begin to enter the salivary glands about the time of moulting, and the fact that they were observed 9–12 days after their first appearance suggests that successive crops enter the salivary glands over a relatively long period. This explains the discovery of parasites in different stages of development in the salivary glands of individual ticks. Soon after penetration of the salivary glands, the parasite becomes a rounded "sporont" and the nucleus is lost. Approximately 8 days after the tick moults, spherical masses constituting "sporoblasts" appear in the interior of the sporonts and buds on their surface, which seem to be sporoblasts in the process of differentiation. The sporoblasts become more clearly defined, and red-staining chromatin appears in irregular masses within them. In the authors' experience this is the limit of the development of the parasite before the ticks containing it are placed on animals with a view to transmitting African Coast fever.

During the first three days of feeding on susceptible animals, the ticks were examined in great detail. After one day the salivary glands of the three infected ticks examined contained sporonts. After two days, three infected ticks contained similar sporonts, but in the fourth the sporoblasts were further separated from the parent mass. In the five infected ticks examined after three days, the chromatin that had previously been distributed irregularly was becoming arranged in small masses at the surface of the sporoblasts, and in many cases the masses had broken loose to form sporozoites containing a single nucleus. Well-formed sporonts were only seen in one of these ticks. The maximum production of sporozoites takes place before engorgement, and after four days the process is taking place with extreme rapidity. When first formed, the sporozoites are somewhat larger than later on, when they are ready for discharge into the lumen of the salivary gland acinus, whence some of them are presumably passed into the animal on which the tick is feeding.

The maximum number of salivary gland cells in any tick containing parasites at any stage in the cycle is about 50 per cent., but the usual infestation is about 8 per cent. On the other hand, even if the infestation should be as small as 0·1 per cent. the individual cells may be heavily charged with parasites. The degree of infestation probably depends on the number of oökinetes that settle in the salivary glands, and the number of parasites in the individual cell upon conditions in the salivary glands adverse or favourable to their development. After engorgement both the percentage of infestation and the cellular charge are apparently reduced. Examination of ticks 6, 8 and 11 days after attachment showed that many of the parasites were degenerating and that the whole mass of parasites may be sloughed off from the cell into the lumen of the acinus. The last parasites were seen 18 days after the tick containing them was placed on a susceptible animal, that is, long after the time of probable transmission of the disease. The authors' experiments did not show how much longer they persisted, but it is probable that they were soon destroyed, as it has been proved experimentally by other workers that the ticks are cleansed by feeding. Three of the four series of ticks that contained parasites in their salivary glands produced typical cases of African Coast fever, and it is probable that the other series would also have done so if the animal had not died early.

RIVNAY (E.). **Studies in Tropisms of the Bed Bug** *Cimex lectularius* **L.** —*Parasitology*, xxiv, no. 1, pp. 121–136, 9 figs., 20 refs. Cambridge, 24th March 1932.

An account is given of further work on the reactions of *Cimex lectularius*, L., to various stimuli [*cf. R.A.E.*, B, xviii, 223; xix, 93].

The following is taken from the author's summary: Heat is an important factor in stimulating bed-bugs to obtain food. Light and atmospheric humidity do not influence the reactions to heat to any great extent, but the state of nutrition and moulting interfere with them. The bug detects heat very slowly and at a room temperature of 23°C. [73·4°F.] takes about 1½ mins. to react to the heat of the hand at a distance of 4 cms. At ordinary room temperature a differential temperature of about 2°C. [3·6°F.] was necessary to cause reaction to heat. The bugs are repelled when the temperature is too high. They have a sense of smell, but only react when very close to the odoriferous substance. The odours of blood, muscle, subcutaneous tissue and clean washed skin exert no influence on them. The odour of perspiration, depending upon its state of decomposition, sometimes repels and sometimes attracts them. Of the substances tested, the odours of sebum and cerumen exhibited the greatest attraction. The bugs apparently discriminate between foods by taste. Negative reactions to water counterbalance positive reactions to heat and odour. The tendency to be in contact with an object, rather than the negative reaction to light, underlies the gregarious habit of the bugs as well as their search for places of shelter.

MATHIS (C.) & DURIEUX (C.). **Identité, à Dakar, de** *Spirochaeta duttoni* **var.** *crocidurae* **et du spirochète infectant dans la nature** *Ornithodorus erraticus*.—*C. R. Acad. Sci. Fr.*, cxciv, no. 12, pp. 1107–1109, 1 ref. Paris, 1932.

An account is given of experiments undertaken to ascertain whether the spirochaete causing relapsing fever at Dakar, which is a variety of *Spirochaeta duttoni* [var. *crocidurae*], is identical with that found in *Ornithodorus erraticus*, Lucas (*marocanus*, Vélu) in the same area [*cf. R.A.E.*, B, xx, 82, 102]. Nymphs of this tick were placed on two mice, which both showed spirochaetes in their blood on the 5th day. It was found that these spirochaetes could easily be maintained by passage from mouse to mouse, which showed that they belonged to the group of *S. duttoni*. They were only with great difficulty inoculated into the guineapig and could not therefore belong to the group of *S. hispanica*.

Furthermore, cross-immunity tests with various strains of *S. duttoni* var. *crocidurae* and spirochaetes infecting *O. erraticus* and one of the relapsing fever cases associated with it [xx, 82] showed results sufficiently definite for the conclusion to be reached that they are identical, and that *O. erraticus* is the vector of the Dakar form of relapsing fever.

Arakawa (Y.). **The Effect of Temperature on the Development of** *Pediculus corporis* **De Geer.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 1, pp. 8–14. Tokyo, 1932.

In experiments on the effect of various temperatures on the development of *Pediculus humanus*, L. (*corporis*, DeG.), 40°C. [104°F.] was found to be the critical temperature, half the lice dying. The duration of the larval stage in days was found to vary as follows: 22–23 at 22–24°C. [71·6–75·2°F.], 20–21 at 27°C. [80·6°F.], 15–16 at 30°C. [86°F.], 11–12 at 34°C. [93·2°F.], 10 at 37°C. [98·6°F.], and 12–13 at 104°F.

Arakawa (Y.). **The Effect of Temperature on the Hatching of Eggs of** *Pediculus corporis* **De Geer.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 1, pp. 29–36. Tokyo, 1932.

In an experiment 77·3 per cent. of the eggs of *Pediculus humanus*, L. (*corporis*, DeG.) failed to hatch when kept at a temperature of 39–40°C. [102·2–104°F.].

Balfour-Browne (F.). **A Text-Book of practical Entomology.**—Cr. 4to, viii+191 pp., 116 figs. London, E. Arnold & Co., 1932. Price 18*s*.

This book is divided into three main parts, arranged so as to provide the basis for three graduated courses on entomology. It deals chiefly with the morphology of insects, with the addition of many details of the best technique for the study of this subject. The last part contains an important section on the external morphology of insect types. The work is illustrated with a large number of original drawings, and it should prove equally valuable to the teacher and the student.

[Pavlovskiĭ (E. N.).] **Павловский (Е. Н.). Methods of estimating the Incidence of Ectoparasites, Transmittors and Causal Agents of infectious Diseases of domestic Animals.** [*In Russian.*]—Med. 8vo, 87 pp., 33 figs., 17 refs. Moscow, Gos. Izd. sel'skokhoz. kolkhoznokoop. Liter. [State Pub. agric. co-op. Lit.], 1931. [Recd. May 1932.]

This handbook on the study of Arthropods attacking domestic animals and poultry in various parts of the Russian Union is largely based on observations of the author or his collaborators. Two chapters deal with ticks and their relation to piroplasmosis of cattle, detailed instructions being given for their collection on the animals or in pasture land, observations on their biology and ecology, the examination of the cattle for infection with piroplasmosis, and the collection of ectoparasites from small animals and birds that may be intermediate hosts of the ticks. Two further chapters contain general information on the biology and economic importance of Oestrids and Tabanids. Various programmes are outlined for obtaining data on Arthropods attacking domestic animals and poultry, and separate chapters deal with the collection of material from slaughtered animals and with observations at the stopping places of droves of cattle and at quarantine stations. Instructions are given on the technique of collecting, preserving and packing Arthropods attacking animals, and forms are appended for periodical registration of the condition of animals, the incidence of their pests, etc., with a list of the more important Russian works on the subject.

STEWART (M. A.). **Dispersal of the Sticktight Flea of Hens** (*Echidnophaga gallinacea* **Westw.).**—*J. Econ. Ent.*, xxv, no. 2, pp. 164–167. Geneva, N.Y., April 1932.

Notes are given on the hosts and distribution of *Echidnophaga gallinacea*, Westw., which is a serious pest of fowls in the United States. Accidental hosts of this flea in North America, which are not important as dispersal agents but may aid in maintaining an infestation, include man, dogs, cats, horses, the domestic turkey, and certain wild mammals and birds. A number of other birds, including the English sparrow, act as dispersal agents. Although it would be unwise under any but extreme circumstances to take direct control measures against them, it should be remembered that various birds are capable of initiating, maintaining and spreading infestations of *E. gallinacea*.

FREEBORN (S. B.) & REGAN (W. M.). **Fly Sprays for Dairy Cows—A Progress Report.**—*J. Econ. Ent.*, xxv, no. 2, pp. 167–174, 1 graph, 2 refs. Geneva, N.Y., April 1932.

These experiments are in continuation of previous work on the relation of flies and fly sprays to milk production [*R.A.E.*, B, xiv, 27; xvi, 227].

The following is the authors' abstract: Fly sprays of petroleum oils carrying pyrethrum, pine oil, or both, designed to keep flies from dairy cows were tested for their efficiency. It was shown that all had approximately the same efficiency for the first half hour but differed at subsequent intervals, pine oil increasing their efficiency in proportion to the amount applied.

Burning followed the use of oils having a viscosity lower than 40 seconds, irrespective of the unsulphonated residue, while oils with unsulphonated residues below 90 per cent. were dangerous if of higher than 65 seconds viscosity. The pyrexial point, defined as the environmental temperature beyond which cows could not maintain a normal body temperature, was determined for the experimental animals. The application of oil sprays lowers this pyrexial point approximately 5°F. by impairing the small amount of cooling that takes place through the action at the surface of the skin. The different sprays varied in their effects on this pyrexial point, and experiments are now under way to throw more light on this question.

HERMS (W. B.). **Insect Parasitology.**—*J. Econ. Ent.*, xxv, no. 2, pp. 222–232. Geneva, N.Y., April 1932.

The following is taken from the author's summary: The study of insect parasitology offers much of interest to workers in the various fields of entomology. An understanding of the sucking mechanism with its chemical products, and the effect of these on animals is a matter of prime importance. The problem of host specificity and host range are matters of concern to medical entomology. The study of insect parasitology becomes most significant in relation to the transmission of pathogenic micro-organisms. This relationship remains incomplete without a knowledge of reservoir animals. The curricular requirements for adequate training in the field of insect parasitology are not now met through the channels of entomology alone. The insect parasitologist should first of all be a fundamentally well-trained biologist.

LINDQUIST (A. W.). *Alysia ridibunda* **Say, parasitic on Blowfly Larvae.**—*J. Econ. Ent.*, xxv, no. 2, pp. 414–415. Geneva, N.Y., April 1932.

The Braconid parasite, *Alysia ridibunda*, Say, emerged from blow-fly larvae trapped in observation jars in New Mexico and Arizona between 20th August and 4th September 1931. A total of 512 emerged from 13 of the jars, which were narrow-mouthed and supplied with a 4-mesh screen top, the bottom being covered with sand on which 4 oz. of lean beef was laid to induce blow-fly oviposition. This is apparently the first record of a host for *A. ridibunda*, which occurs in Canada and has a wide distribution in the United States.

DYER (R. E.), RUMREICH (A. S.) & BADGER (L. F.). **The Typhus-Rocky Mountain Spotted Fever Group in the United States.**—*J. Amer. Med. Ass.*, xcvii, no. 9, pp. 589–594, 3 charts, 30 refs. Chicago, Ill., 29th August 1931.

The early work on endemic typhus in the United States and Mexico and on Rocky Mountain spotted fever is briefly reviewed, and a more detailed account is given of later researches on endemic typhus and the eastern type of Rocky Mountain spotted fever, with particular reference to the authors' own investigations, most of which have already been noticed [*R.A.E.*, B, xix, 93, 155, 195].

MOOSER (H.) & CASTANEDA (M. R.). **The Multiplication of the Virus of Mexican Typhus Fever in Fleas.**—*J. Exp. Med.*, lv, no. 2, pp. 307–323, 1 pl., 5 refs. Baltimore, Md., 1st February 1932.

An account is given of further work on the ectoparasites of rats in Mexico City with reference to the part played by them in the transmission of Mexican typhus [*R.A.E.*, B, xx, 50, 130]. The parasites found were *Echinolaelaps* (*Laelaps*) *echidninus*, Berl., *Liponyssus bacoti*, Hirst, *Polyplax spinulosa*, Burm., *Xenopsylla cheopis*, Roths., *Leptopsylla segnis*, Schönh. (*musculi*, Dug.), *Ceratophyllus fasciatus*, Bosc, *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., and *C.* (*C.*) *felis*, Bch. *P. spinulosa* has already been shown to be capable and *E. echidninus* incapable of transmitting the disease [xx, 131]. Examinations of numerous individuals of *L. bacoti* 9–10 days after feeding on an infected rat revealed no rickettsiae, nor was it possible to demonstrate the presence of infection [*cf.* xix, 178 ; xx, 49]. The experiments described were therefore undertaken to determine in which species of fleas the virus is able to survive. Each species was fed on white rats inoculated with Mexican typhus, and the results were obtained from smears and serial sections of the fleas, and from inoculations of suspensions of the fleas into guineapigs.

It was found that the virus of Mexican typhus multiplies with extraordinary regularity in all species, the fleas being so susceptible that not a single individual failed to contract infection with *Rickettsia prowazeki*. In this respect fleas are even more susceptible than *Pediculus humanus*, L., or *Polyplax spinulosa*, for a certain number of lice always fail to contract infection in feeding experiments. In lice and fleas there is considerable multiplication of rickettsiae in the epithelial cells of the intestinal canal, but in fleas there is, in addition, a progessive invasion of the malpighian tubules, particularly at the proximal end, such multiplication being proportionate to the length of time after infection. No rickettsiae were seen in the salivary glands or genital organs of fleas. In both *Pediculus* and *Polyplax*, the organisms continue to multiply, causing the death of the host in a short time, whereas in fleas the intestinal infection is apparently arrested and the lining epithelium is capable of being regenerated. This explains the fact that in experiments with *Xenopsylla cheopis* the fleas remained alive for more than a month after infection. These facts may indicate that fleas are more closely adapted to typhus than lice, which may not yet have had sufficient time, in the biological sense, to convert rickettsiae by adaptation into harmless saprophytes.

The results obtained suggest that typhus, which until recently has been regarded as a specific disease of man, was originally and exclusively a disease of rodents from which, in time, it has been transferred to man by fleas. The longevity of fleas marks them as potentially more dangerous than lice, but from a practical point of view they are usually much less so, and in regions where endemic typhus occurs it is rare to find two cases of the disease in the same household. The relative harmlessness of fleas may be partly explained by the fact that in fleas as well as in lice the virus leaves the body of the insect only with the faeces. The salivary glands remain uninfected, and in the oesophagous the virus has been found only in the posterior region. The lumen of the flea's intestine contains a small number of rickettsiae only, as compared with the contents of the intestine of the louse. Apparently the peritrophic membrane of the flea prevents the discharge of any considerable numbers of rickettsiae into the lumen, and consequently the faeces of the flea are less likely to be infectious than those of the louse. Also it may be assumed that isolated flea bites are usually far less irritating to man than those of *Pediculus humanus*, and therefore lead to far less scratching and consequent inoculation. Moreover, the body of the flea is more strongly chitinised than that of the louse and is less likely to be crushed. The likelihood of transmission of the virus from rat to man in endemic regions is further diminished by the disinclination of the rat fleas to attack man, and as typhus, in contradistinction to plague, does not kill rats under ordinary circumstances, there is little occasion for the fleas to leave their normal hosts.

The variety of flea concerned in transmission probably depends on climatic conditions, *Xenopsylla* being important in the tropical and subtropical regions and *Ceratophyllus fasciatus* in more northerly climates. *Ctenocephalides felis* and *C. canis* are probably of little importance, as they are scarce on rats. *Leptopsylla segnis* does not apparently attack man.

Pulex irritans, L., has also been infected by allowing it to feed on human typhus cases and on infected guineapigs, but it is not considered to be of epidemiological importance in view of the fact that secondary infections are rarely observed even in buildings not entirely free from fleas.

DYER (R. E.), WORKMAN (W. G.), BADGER (L. F.) & RUMREICH (A.). **The Experimental Transmission of Endemic Typhus Fever of the United States by the Rat Flea** *Ceratophyllus fasciatus*.—*Publ. Hlth. Rep.*, xlvii, no. 17, pp. 931–932, 8 refs. Washington, D.C., 22nd April 1932.

As it has been shown that *Ceratophyllus fasciatus*, Bosc, can be infected with Mexican typhus [see preceding paper], experiments were undertaken to determine its ability to transmit the endemic typhus of the United States.

Three white rats freshly inoculated with endemic typhus were placed in a box with uninfected fleas; 14 days after the first and 6 days after the last infected rat had been placed in the box, 5 fleas were removed, emulsified in salt solution and injected intraperitoneally into two guineapigs. One of these developed clinical endemic typhus after an incubation period of 10 days. The virus from this guineapig, which was subsequently studied in other animals, was identified as that of endemic typhus by means of 6 criteria, which are listed. The successful recovery of endemic typhus virus from fleas in the same box was repeated twice, using an emulsion of 8 individuals in the first case and 10 in the second.

Three normal white rats were then placed in a second box with a number of fleas from the first. These rats were killed 12, 13 and 14 days later and their spleens inoculated into guineapigs. Endemic typhus virus was recovered from the guineapig inoculated with the spleen of the rat killed 13 days after its first exposure to infected fleas.

Dyer (R. E.), Workman (W. G.), Ceder (E. T.), Badger (L. F.) & Rumreich (A.). **The Multiplication of the Virus of Endemic Typhus in the Rat Flea** *Xenopsylla cheopis*.—*Publ. Hlth. Rep.*, xlvii, no. 18, pp. 987–994, 8 refs. Washington, D.C., 29th April 1932.

Descriptions are given of experiments undertaken to determine whether a multiplication of the virus takes place in fleas infected with the endemic typhus of the United States or whether the virus is carried mechanically. A preliminary titration of an emulsion of crushed infected fleas (*Xenopsylla cheopis*, Roths.) showed that an amount of emulsion containing one-fiftieth of a flea was sufficient to induce typical reactions in a guineapig. Experiments were then carried out with dilutions of infected flea emulsions corresponding to two fleas or fractions of a flea varying from $\frac{1}{2}$ to $\frac{1}{128,000}$ inoculated into normal guineapigs at intervals of 1–40 days after the infecting feed. The results show that there was an enormous multiplication of the virus in the flea, for whereas $\frac{1}{2}$ flea did not contain enough virus surely to infect a guineapig until 3 days after feeding on infected rats, $\frac{1}{32}$ flea was sufficient to infect a guineapig after that time. After 40 days three guineapigs each inoculated with $\frac{1}{128,000}$ flea became infected. Some guineapigs inoculated with flea emulsion made 40 days after the infecting feed showed a lengthened incubation period, suggesting that the concentration of virus in the flea reached a maximum and then diminished. No rickettsiae were found in smears made in the first two days after the infecting feed, but they were readily found after that time.

Kodama (M.), Kono (M.) & Takahashi (K.). **Demonstration of** *Rickettsia manchuriae* **appearing in the Stomach Epithelial Cells of Rat Fleas and Rat Lice infected with so-called Manchurian Typhus.**—*Kitasato Arch. Exp. Med.*, ix, no. 2, pp. 91–96, 1 pl., 5 refs. Tokyo, April 1932.

The authors consider that the benign sporadic typhus that occurs in Manchuria [*R.A.E.*, B, xx, 100] is identical with Brill's disease and endemic typhus in Mexico and in Brazil (where the causal agent [in guineapigs] has recently been described as *Rickettsia brasiliensis*). Of 49 rats captured in a region where the disease occurs, two (*Mus norvegicus*) were found by subinoculation to be infected, and rickettsiae were discovered in the epithelial cells of the stomach and malpighian tubes of one out of four *Xenopsylla cheopis*, Roths., taken from them. Of 15 *X. cheopis* placed on a house rat that had been artificially infected with Manchurian typhus 6 were recovered 15 days later. Stomach cells containing rickettsiae were found to be numerous in one of these fleas and comparatively few in another. Smears were made of the four remaining fleas, and rickettsiae were observed in two. Rickettsiae in masses were also seen in the stomach cells of lice (*Polyplax spinulosa*, Burm.) from a white rat inoculated with benign typhus. No rickettsiae were found in the epithelial cells of the stomachs of 78 fleas or 85 lice collected from 17 normal rats.

From these experiments it is concluded that the rickettsiae observed in the fleas and lice are *Rickettsia manchuriae*, which is regarded as the causal agent of benign sporadic typhus [*loc. cit.*].

The authors are of the opinion that the causal agent of typhus is widely distributed among rodents, at least in typhus regions, and is transmitted by *X. cheopis* to man in the form of mild endemic typhus (under various names). In the course of succeeding passage through the body louse [*Pediculus humanus*, L.] the organism changes into *R. prowazeki* and causes genuine typhus in man. They also consider that it may again be transmitted by rat fleas from man to rat and then from rat to rat by fleas or rat lice so that it resumes its original form.

Kodama (M.), Takahashi (K.) & Kono (M.). **On Experimental Observation of the so-called Manchurian Typhus and its Etiological Agent** (*Rickettsia manchuriae*).—*Kitasato Arch. Exp. Med.*, ix, no. 2, pp. 97–133, 2 pls., 31 refs. Tokyo, April 1932.

In this paper, which is based on the literature and on the authors' own observations, the reactions of typical typhus in laboratory animals are compared with those of Manchurian typhus. It was found that in guineapigs inoculated with a suspension of body lice [*Pediculus humanus*, L.] fed on a guineapig infected with Manchurian typhus, the scrotal reaction typical of this disease did not develop, although it was produced in other guineapigs after three to five subinoculations. It thus appears that passage through *P. humanus* temporarily decreases the power of Manchurian typhus to produce the typical reaction in guineapigs.

Blanc (G.) & Caminopetros (J.). **Etudes épidémiologiques et expérimentales sur la fièvre boutonneuse, faites à l'Institut Pasteur d'Athènes.**—*Arch. Inst. Pasteur Tunis*, xx, no. 4, pp. 343–394, 26 pls., 3 diag., 3 graphs, 3 pp. refs. Tunis, 1932.

A detailed account is given of the investigations carried out by the authors on Marseilles fever in Greece, much of the information having already been noticed [*R.A.E.*, B, xix, 200, 224; xx, 99]. A series of 52 further experiments in which 97 persons were inoculated with suspensions of all stages and both sexes of *Rhipicephalus sanguineus*, Latr., from various regions in Greece, confirmed the frequency of infection among ticks from Piraeus and Volo [xx, 99] and demonstrated its rarity or absence among those from Athens, Khephissia, Salonika, Chalcidice and Canea (Crete). Ticks from Delos were found to be infective. Positive results were obtained on inoculation of suspensions of eggs, larvae, nymphs, and adults of both sexes. Experiments with carefully washed eggs and larvae from infected females showed that the virus of Marseilles fever can be transmitted hereditarily, thus demonstrating the possibility of the infection being maintained in a particular locality without the intervention of a vertebrate host.

DURAND (P.). **La réaction de Weil-Felix dans la fièvre boutonneuse.**—*Arch. Inst. Pasteur Tunis*, xx, no. 4, pp. 395–421, 17 graphs.
DURAND (P.) & LAIGRET (J.). **La "Fièvre de Marseille" immunise contre la fièvre boutonneuse de Tunisie.**—*T.c.*, pp. 422–425.
DURAND (P.) & LAIGRET (J.). **Sensibilité de certains rongeurs au virus de la fièvre boutonneuse.**—*T.c.*, pp. 426–429, 2 figs. Tunis, 1932.

From experiments described in the first paper, it is concluded that Marseilles fever is a disease that by certain methods of examination constantly gives a positive Weil-Felix reaction. It therefore belongs to the typhus group of fevers.

The second paper shows that a strain of Marseilles fever from a case in man in Tunis and one originating in *Rhipicephalus* [*sanguineus*, Latr.] from Marseilles, confer immunity to a second Tunisian strain, thus demonstrating the identity of the virus in man and ticks.

Experiments described in the third paper indicate that inoculation of a strain of Marseilles fever from man into gerbilles and white rats produces an inapparent form of the disease that is transmissible by subinoculation to man and that these animals may therefore act as reservoirs of the disease in nature.

COLAS-BELCOUR (J.). **Contribution à l'étude de *Rhipicephalus* (*Pterygodes*) *fulvus* Neumann et de sa biologie.**—*Arch. Inst. Pasteur Tunis*, xx, no. 4, pp. 430–443, 5 figs., 9 refs. Tunis, 1932.

The author describes the larva, nymph and female of *Rhipicephalus fulvus*, Neum., which was originally described from a single male, giving additional measurements taken from a larger number of males. The larvae and nymphs have been found on *Ctenodactylus gundi* in various localities, and the area of distribution of the tick appears to coincide with that of the rodent, which lives under stones in rocky regions. It has been found in the south of Tunisia and probably occurs in the south of Algeria and Tripoli. Adults have been taken on goats and sheep and more rarely on camels. Fragmentary observations indicate that there is one generation a year. The larvae, which hatch in spring, infest *C. gundi*. The nymphs leave these rodents in April–May to moult beneath stones. The adults attach themselves to goats or sheep and do not leave these hosts until the winter, when they drop to the ground and oviposit. It is suggested that this tick may act as a vector of *Babesiella ovis*.

GOBERT (E.). **Le contrôle permanent de la peste en Tunisie.**—*Arch. Inst. Pasteur Tunis*, xx, no. 4, pp. 456–469, 5 pls., 2 fldg. diag. Tunis, 1932.

After briefly reviewing the history of plague in Tunisia, the author gives a detailed account of the equipment and methods at present employed for trapping rats and determining plague infection in the town of Tunis, together with a description of the mobile laboratory that has been constructed to enable research on plague to be carried out in the interior, where the problem is more complicated.

Dr. A. Wassilieff [Vasil'ev] discusses the lines on which this research is being carried out and points out one or two of the results already obtained. A large number of fleas occurred in the nests of *Meriones* at a depth of 39 inches, whereas only isolated individuals were found in nests nearer to the surface. Thus it appears that the depth of the burrows favours the survival of both rodents and their parasites. *Stenoponia tripectinata*, Tirab., was the predominating species in the locality where this observation was made. The discovery of such numbers at the time of the rains confirms the relation between humidity and the breeding of fleas. On the other hand the numbers of ticks on the animals and in their burrows decreased at this season. Of 5 fleas captured in native huts where plague had occurred, 2 were *Pulex irritans*, L., and 3 species associated with rodents, *viz.*, *Ceratophyllus maurus*, J. & R., and *Xenopsylla ramesis*, Roths., showing that in the absence of their natural hosts these fleas enter dwellings and attack man.

QUÉRANGEL DES ESSARTS (J.). **Présence d'un virus exanthématique sur les rats d'un navire de guerre, au Port de Brest. Rats et puces des rats à Brest.**—*Bull. Soc. Path. exot.*, xxv, no. 4, pp. 283–286. Paris, 1932.

A second case of exanthematic fever is recorded from Brest, originating on the same ship as the first and having identical symptoms [*R.A.E.*, B, xx, 100]. The brains of rats captured on board various ships and in the port were inoculated into male guineapigs, and a positive reaction was obtained with the brain of a rat (*Mus rattus*) from the ship on which the cases had originated. An examination of the ectoparasites of rats showed that *Polyplax spinulosa*, Burm., was numerous on all the rats ; *Dermanyssus muris*, Hirst, occurred on all species of rats, on ships or on shore, at the rate of 1–5 per rat, but appeared to be more numerous on ship rats, particularly *M. rattus* ; and fleas were present at an average rate of 2–5 per rat, but on board ship *Xenopsylla cheopis*, Roths., predominated, and on shore *Ceratophyllus fasciatus*, Bosc. Inoculations of suspensions of these ectoparasites into guineapigs gave negative results.

WAGNER (J.) & ROUBAUD (E.). **Sur un pulicide nouveau, parasite des rats à Madagascar.**—*Bull. Soc. Path. exot.*, xxv, no. 4, pp. 327–332, 4 figs., 2 refs.

FONQUERNIE (J.). **Les puces du rat à Tananarive.**—*T.c.*, pp. 383–386. Paris, 1932.

The second paper gives the results of a rat-flea survey of Tananarive extending over a year, in the course of which 30,625 fleas were examined belonging to the following species : *Xenopsylla cheopis*, Roths., *Leptopsylla segnis*, Schönh. (*musculi*, Dug.), *Echidnophaga gallinacea*, Westw., *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., *Pulex irritans*, L., and an undetermined species. This is described in the first paper as *Synopsyllus fonquernii*, gen. et sp. n. Tables are given showing the monthly prevalence of the fleas and the monthly index for *X. cheopis*.

GIRARD (G.), ROBIC (J.) & HERIVAUX (A.). **Note sur les puces de la région de Tananarive.**—*Bull. Soc. Path. exot.*, xxv, no. 4, pp. 381–383, 1 ref. Paris, 1932.

As the authors consider that there is no longer any doubt that transmission from man to man plays an important part in the spread not only of pneumonic but also of bubonic plague in the region of Tananarive [*cf. R.A.E.*, B, xviii, 250], a flea survey was undertaken in dwellings with a view to determining the ectoparasites capable of transmitting infection from an infected man or corpse. Of 3,000 fleas taken from buildings free from plague, either from the floor by means of traps or from the bodies of natives or Europeans, 91 per cent. were *Pulex irritans*, L., 8 per cent. *Ctenocephalides* (*Ctenocephalus*) and 1 per cent. *Echidnophaga gallinacea*, Westw. Of 526 fleas collected in rat-infested warehouses in a plague infected area, 341 were *P. irritans*, 184 *Ctenocephalides* and 1 *Xenopsylla cheopis*, Roths. Of fleas collected from houses where plague-infected corpses had lain, 232 were *P. irritans*, 63 *Ctenocephalides*, 4 *X. cheopis* and 11 *E. gallinacea*. Negative results were obtained when suspensions of 126 of these fleas (including the 4 *X. cheopis*) were inoculated into guineapigs and mice. It thus appears that the true domestic flea is *P. irritans* (the predominance of *Ctenocephalides* in certain houses being due to the presence of dogs or cats) and that *X. cheopis* is rarely found except on rats even in plague-infected dwellings. The survey was carried out from October 1930 to August 1931, and it was found that fleas were abundant from October to March during the annual period of recrudescence of plague, and rare from April to July, the period when the infection is dying out, although the proportions of the various species remained the same.

MEIRA (J. A.). **Alguns dados estatisticos sobre as pulgas dos ratos na cidade de São Paulo.** [Some statistical Data on Rat Fleas in the City of S. Paulo.]—*Ann. Fac. Med. S. Paulo*, vi, pp. 73–77. S. Paulo, 1931. [Recd. May 1932.]

A flea-index of 12·75 was found for 235 rats and 65 mice captured in the city of S. Paulo, Brazil, from 16th June to 11th August 1931. Only 29 rats and 22 mice were uninfested. Of the fleas found on both rats and mice, 60·99 per cent. were *Leptopsylla segnis*, Schönh. (*Ctenopsylla musculi*, Dug.), 24·83 per cent. *Xenopsylla brasiliensis*, Baker, 12·41 per cent. *X. cheopis*, Roths., and 1·56 per cent. *Ceratophyllus fasciatus*, Bosc. Two individuals of *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., and *Pulex irritans*, L., and one of *Synosternus pallidus*, Tasch., were found on rats.

NORDBERG (S.). **Undersökningar rörande aphanipterlarvernas näringsbiologi.** [Investigations on the Feeding Habits of Flea Larvae.]—*Notul. ent.*, xi, no. 3–4, pp. 160–164. Helsingfors, May 1932.

Investigations indicate that the larvae of *Ceratophyllus gallinae*, Schr., and *C. hirundinis*, Curt., feed for preference on the excrement of the adults, but that failing this they can survive on other organic material.

TROLLI (G.). **Rapport préliminaire au sujet de la présence et de la vitalité des insectes et des rats, et notamment des moustiques, à bord des avions au Congo Belge.**—*Bull. Off. int. Hyg. publ.*, xxiv, no. 4, pp. 603–612. Paris, April 1932.

After describing the air routes at present in use in the Belgian Congo and briefly discussing the insect-borne diseases existing there, the author gives an account of preliminary investigations on the presence of insects and rats in aeroplanes, with a view to determining the likelihood of certain diseases being spread in this way.

The only insects found were mosquitos of the genus *Mansonia* (*Mansonioides*), which were taken on four occasions at Coquilhatville in aeroplanes from Leopoldville and Stanleyville, all of which had made calls en route, and species of this genus and of *Culex* in aeroplanes in hangars. Living mosquitos of the genus *Mansonia* sent in cages from Leopoldville to Coquilhatville and Elisabethville were alive on arrival in the former case and dead in the latter. It would appear that the altitude (nearly 8,000 ft.) and the long sojourn in the aeroplane (4 days) were unfavourable to the life of the mosquitos in the second instance. Rat excrement was found in one aeroplane.

Further and more systematic observations on this subject are to be carried out, and instructions to the provincial medical officer at Stanleyville are given in an appendix, together with the form to be carried by the pilot of each aeroplane and filled in by the medical officers at the points of departure and arrival and at the points of call.

MURRAY (G. A.). **Dengue Fever.**—*Health*, ix, no. 11, pp. 105–111. Canberra, November 1931.

From a review of the literature on dengue in Australia the author draws the following conclusions. Dengue fever is an introduced disease that has now become endemic, at least in northern Queensland and the northern part of Western Australia. North Australia may be an endemic area, but is more probably infected by extension of epidemics from Western Australia. From the endemic areas in Queensland widespread epidemics periodically arise, affecting not only southern Queensland but sometimes the north coastal area of New South Wales. The importation of dengue from overseas is not in itself regarded as causing epidemics on the eastern coast, but it cannot be definitely shown that it has no share in determining these epidemic prevalences. The reported distribution of *Aëdes argenteus*, Poir., coincides fairly accurately with the areas affected by the disease, except occasionally in the northern coast area of New South Wales. Dengue has never extended beyond the known limits of distribution of *A. argenteus*. *A. albopictus*, Skuse, is not sufficiently widespread in Australia to be regarded as an important vector.

STUPPY (C.). **Uebertragung von Hühnerpocken durch Mücken.** [The Transmission of Fowl-Pox by Mosquitos.]—*Zbl. Bakt.* (1 Abt. Orig.) cxxiii, no. 3–4, pp. 172–178, 6 figs., 13 refs. Jena, 1931.

STUPPY (C.). **Uebertragung von Geflügelpocken durch Mücken.**—*Deuts. tierärztl. Wschr.*, xl., no. 17, pp. 260–264, 4 figs., 16 refs. Hanover, 1932.

Both these papers deal with the same set of experiments made in Hamburg. Some of the previous work on the transmission of fowl-pox by mosquitos is very briefly noticed [*R.A.E.*, B, xvii, 241 ; xviii, 127 ; xix, 111]. Both *Culex pipiens*, L., and *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) transmitted the disease 8, 19, and 39 days after feeding on an infected fowl. The capacity for infection was undiminished 39 days after the mosquito had become infected, and it probably remains infective for life. Incubation took 6–10 days, and the infection due to a bite sufficed to confer immunity. From an experiment in which the disease was produced by inoculating a suspension of infected mosquitos from which the wings, legs and proboscis had been removed, it is concluded that the virus occurs in the mosquito itself and that transmission is not simply mechanical.

Legendre (J.). **Le moustique cavernicole ou l'adaptation de *Culex pipiens* à l'urbanisme moderne.**—*Bull. Acad. Méd.*, (3) cvi, no. 28, pp. 86–89. Paris, 3rd August 1931.

Legendre (J.). **Le moustique stercoraire.**—*T.c.*, no. 34, pp. 276–280. Paris, 9th November 1931.

Legendre (J.). **Anthropophilie ou zoophilie chez le moustique commun *Culex pipiens*.**—*Op. cit.*, (3) cvii, no. 9, pp. 317–320, 2 refs. Paris, March 1932.

A mosquito survey of a town in the west of France led to the discovery of *Culex pipiens*, L., breeding in large numbers in flooded cellars, rain-water cisterns and cesspools. The adults emerging from these breeding-places had a light-coloured thorax. As this domestic mosquito has adapted itself to modern urban conditions, it is possible that *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) may adapt itself to similar breeding-places in the course of development of colonial towns. *C. pipiens* was not found in cesspools that receive little or no water.

In the second paper an account is given of further observations on the breeding of *C. pipiens* in cesspools, which were found to be the most important source of infestation and to produce the mosquitos that attack man most voraciously. The eggs may be laid on the surface of the water in the closet pan, or in the flush cistern unless the cover is hermetically sealed, whence they are carried by flushing into the cesspool. On the other hand, they may be deposited directly on the surface of the water in the cesspool by females entering down the vent pipe, through holes or cracks in the man-hole cover, or through the soil pipe if this cannot be flushed. The emerging adults leave the cesspool by the same means. Control by preventing the exit of the adults is most easily effected, as it is only necessary to provide for the flushing of the soil pipe, the sealing of the man-hole and the covering of the end of the vent pipe with mosquito-proof wire gauze. For urinals it is necessary to find some means of permitting drainage and yet preventing the entrance and exit of adult mosquitos.

In the third paper the author points out that in a building where the measures suggested above were carried out, the mosquitos disappeared in a few days. Moreover, the pans and cisterns acted as traps for the eggs of mosquitos that would have deposited them elsewhere if they had been prevented from gaining access to these receptacles.

In the same town, there is a race of *C. pipiens* with a dark thorax that breeds in surface waters and does not attack man. Whether this race is indigenous or the progeny of a strain introduced by the author from Brittany [*cf. R.A.E.*, B, xvii, 80, etc.] is not known. For two years, however, the author has observed, as in the other locality where the same race was introduced [xiii, 26], that not a single adult mosquito has attracted attention even within a few yards of prolific breeding-places. During 1931, five new centres for the propagation of this race were established in the town with adults from the last-mentioned locality or from Brittany, in the hope that the zoophilous race will replace the anthropophilous one. It is doubtful whether the former will adapt itself, as the latter has done, to subterranean breeding-places, or whether, if the larvae are nourished on the products of human excrement, the adults will preserve their aversion from human blood.

Magrou (J.), Magrou (M.) & Roubaud (E.). **Action stimulante à distance, exercée par certaines suspensions bactériennes, à travers le quartz, sur l'éclosion du moustique de la fièvre jaune.**—*C. R. Acad. Sci. Fr.*, cxcii, no. 18, pp. 1134–1136, 2 refs. Paris, 1931. (Abstract in *Trop. Dis. Bull.*, xxix, no. 2, p. 134. London, February 1932.)

It is known that eggs of *Aëdes argenteus*, Poir. (*aegypti*, auct.) containing larvae ready to hatch may remain dormant for long periods in the absence of certain stimuli [*R.A.E.*, B, xviii, 35, etc.]. The authors have found that 24-hour cultures of *Bacterium tumefaciens* or 8-hour cultures of *Staphylococcus aureus* will produce the hatching of the larvae when separated from the water containing the ripe eggs by means of a quartz plate. The emanations from the cultures of *B. tumefaciens* caused 31 out of 194 eggs to hatch in 24–48 hours, whilst out of 203 eggs kept as controls at the same temperature none hatched. Similarly, of 78 eggs exposed to the emanations from *Staphylococcus* 7 hatched in 24 hours, whilst of 69 eggs kept as controls none hatched. Moreover, eggs that did not hatch after exposure to these emanations were more susceptible to other stimuli than normal eggs, as a higher percentage of them hatched when they were subsequently slightly shaken. When the quartz plate was replaced by glass, the cultures also had a slight stimulating effect on the hatching of eggs, but to a much less degree than when quartz was used.

Roubaud (E.). **Les races trophiques de l'*Anopheles maculipennis* décelées par les élevages expérimentaux comparés.**—*C. R. Acad. Sci. Fr.*, cxciv, no. 19, pp. 1694–1696, 1 ref. Paris, 1932.

The author carried out experiments in Paris with various European strains of *Anopheles maculipennis*, Mg., in order to test his theory of the existence of races with different feeding habits [*R.A.E.*, B, xvi, 210, etc.]. The work was done during the winter when the insects are most easily and safely transported from a distance. Some sent by air from Italy arrived frozen and apparently dead, but they all revived completely when exposed to warmth and moisture. In a comparative study in which mosquitos of various European strains were given opportunites of feeding on man or guineapigs, the only strains showing constant preference for man were those of which the maxillary index was never above 14 [*loc. cit.*]. Human blood was essential for the breeding of these strains. All the strains having an index of over 14 preferred guineapigs to man and were easily reared on them. Females with a high index become engorged more quickly on animals than do those with a low one, which become fully fed much more easily on man. Of two Italian strains, the one from a non-marshy district had a high index and was zoophilous, and the one from a very marshy area had a low index and preferred to feed on man, a fact that provides further confirmation of the significance of these data with regard to the general development of malaria in Europe.

[NABOKOV (V. A.).] **Набоков (В. А.) Control of the Larvae of Malaria Mosquitos.** [*In Russian.*]—*Aviatz. bor'be Vredit. sel'sk. i lesn. Khoz.* [*Aviation in Control of Agric. & Forest Pests.*] *Mater. 1st All-Union Avio-Chem. Conf. Moscow 1930*, pp. 55–88, 4 figs. Moscow, Sel'kolkhozgiz [Agric. Co-op. Pub.], 1932.

An account is given of experiments in aeroplane dusting with Paris green against Anopheline larvae, carried out near Moscow in 1929 [*R.A.E.*, B, xix, 21; xx, 116], and in the swamps formed by the river Arax in the Mugan Steppe in southern Azerbaijan in 1930. In the latter region conditions are favourable for Anopheline breeding from May to November in vast flooded areas and numerous lakes, as well as in neglected irrigation channels. For dusting small accumulations of water, the aeroplane flew at a height of about 16 ft., and in the case of extensive water surfaces at 32–65 ft., an area of over 20,000 acres being thus treated within a radius of 19–22 miles. On an average the effective strip of dust was nearly 400 ft. wide. Paris green mixed with equal parts of talc or road dust and applied at the rate of 7–10 oz. of the poison to the acre in case of waters with submerged vegetation, and of 0·9 lb. to the acre where the vegetation was above the surface and dense, killed all the older Anopheline larvae and 60–80 per cent. of the young ones in 24 hours; after repeated dusting, the rate of mortality among the young larvae rose to 75–100 per cent. The examination of the treated waters in 10 days showed a marked decrease in the rate of infestation. The cost of treatment is discussed and shown to be much lower than that of oiling or applying Paris green by hand.

[SAZONOV (I. V.) & STREGULINA (E. S.).] **Сазонов (И. В.) и Стрегулина (Е. С.). Control of the Red Spider Mite (Chor) and of the Larvae of the Malaria Mosquito in Armenia.** [*In Russian.*]—*Aviatz. Bor'be Vredit. sel'sk. i lesn. Khoz.* [*Aviation in Control of Agric. & Forest Pests.*] *Mater. 1st All-Union Avio-Chem. Conf. Moscow 1930*, pp. 180–210. Moscow, Sel'kolkhozgiz [Agric. Co-op. Pub], 1932.

Experiments in dusting with Paris green from an aeroplane against Anopheline larvae were carried out in 1930 in a malarious district in southern Armenia, where swamps that result from floods or the irrigation of crops, and accidental accumulations of water near villages, offer very favourable conditions for mosquito breeding. Paris green was mixed with road dust in various proportions. The aeroplane flew at a height of 13–16 ft. and in one instance at 22–26 ft., and for testing purposes small dishes of water containing Anopheline larvae were placed in the swamp at intervals of 16 ft. on a line at right angles to the direction of flight. It was found that the maximum efficiency as regards distribution from the aeroplane was obtained when the dust mixture contained 70 per cent. Paris green, being released at the rate of about 10·5 oz. Paris green to the acre, which produced a width of effective swath varying from 440 to 600 ft. In all experiments a high rate of mortality of the larvae occurred.

[Beklemishev (V. N.).] **Беклемишев (В. Н.). The Importance of colloido-dispersive Substances in the Nutrition of the Larvae of** *Anopheles*. [*In Russian.*]—*Mag. Paras. Mus. zool. Acad. Sci. URSS.*, i, pp. 27–36, 11 refs. Leningrad, 1930. [Recd. May 1932.] (With a Summary in French.)

This preliminary discussion on the food of the larvae of *Anopheles maculipennis*, Mg., is largely based on the literature and on personal investigations that have already been noticed [*R.A.E.*, B, xiv, 130; xvii, 3]. Mosquito larvae may feed in four different ways; they can gnaw hard submerged objects, scrape off the periphyton present on their surface, swallow comparatively large floating bodies such as small Ostracods or Cladocera, and filter small suspended particles from the water. While some mosquitos can only feed in one way, the larvae of *A. maculipennis* can use all four. For gnawing, filamentous algae, and sometimes animal matter, are preferred; macrophytes are seldom attacked, probably because, as has been proved by laboratory analysis, their tissues compared with those of animals or algae are poor in nutritive substances. In an experiment, larvae fed only on tissues of a graminaceous plant developed as slowly and unsatisfactorily as those that were starved. The periphyton scraped off the surface of submerged objects abounds in diatoms, etc., which are rich in fats and albumen, while when swallowing suspended bodies the larvae chiefly catch small forms of mesoplankton and larger ones of the microplankton. The manner in which the larvae filter the water, after having anchored themselves by the caudal hooks [xiii, 11], is briefly described. Besides the nannoseston and bacteria, which the larvae retain by means of their filtering apparatus [xv, 229; xvi, 224], they also feed on particles considerably smaller in diameter than 5μ, and are able to develop on colloid fractions of organic substances present in water, at least up to the fourth instar [xix, 25]. This food, however, is insufficient for the more mature individuals, an important part in their nutrition being played by coarse particles and filamentous algae. Since it has been found that most of the albuminous and fatty matter contained in water of small lakes is present in a colloid-dispersive form, the author believes that this may also apply to the water in ponds or pools, in which the larvae of *A. maculipennis* usually occur. He concludes, therefore, that colloid particles play an important part in the nutrition of young Anopheline larvae, which chiefly feed by filtering. These colloid and ultraseston particles probably form the greater part of the detritis found in the gut of dissected larvae.

[Simanin (P. I.).] **Симанин (П. И.). Contribution to the Question of experimental Infection of Mosquitos with tropical Malaria.** [*In Russian.*]—*Mag. Paras. Mus. zool. Acad. Sci. URSS.*, i, pp. 37–44, 1 pl., 6 refs. Leningrad, 1930. [Recd. May 1932.] (With a Summary in German.)

An account is given of experiments in the Ferghana region of Central Asia in 1928 on the artificial infection of local Anophelines with *Plasmodium falciparum* (*praecox*). The mosquitos were allowed to feed (usually once only) on persons suffering from malignant tertian malaria whose blood contained a large number of gametocytes. Of the five species of mosquitos used, *Anopheles sacharovi*, Favr, *A. pulcherrimus*, Theo., and *A. superpictus*, Grassi, were readily infected, 90, 84 and 77 per cent., respectively, showing oöcysts or sporozoites. *A. hyrcanus*, Pall., and *A. hyrcanus* var. *pseudopictus*, Grassi, remained uninfected in all cases.

[Burakova (L. V.).] **Буракова (Л. В.) The Development of *Phlebotomus* under Laboratory Conditions.** [*In Russian.*]—*Mag. Paras. Mus. zool. Acad. Sci. URSS.*, i, pp. 45–60, 5 figs., 17 refs. Leningrad, 1930. [Recd. May 1932.] (With a Summary in English.)

Details are given of laboratory investigations on sandflies carried out in July 1928 in the town of Termez in southern Uzbekistan. Of the species taken in hospitals, 72·6 per cent. were *Phlebotomus papatasii*, Scop., 24·2 per cent. *P. sergenti*, Parr., and 3·2 per cent. *P. minutus*, Rond. The method employed in breeding the sandflies, which is described, is a slight modification of that used in Assam [*R.A.E.*, B, xiv, 139]. Oviposition usually occurred on the fifth or sixth day after pairing and feeding. If the eggs were laid on the lamp glass, they were collected by means of a fine damp brush and placed in the breeding dish. The average number of eggs laid by a female was 17·5, the maximum being 68. The females usually died in the process of oviposition. Under laboratory conditions they lived for 6–7 days on an average, with a maximum of 14–17, and the males for 5–6 days. The life-cycle of a sandfly from egg to adult was completed in 35–40 days, of which the egg-stage occupied 5–10, and the pupal 8–12. A brief general description of the four instars of the larva is given, and the results of the breeding experiments are tabulated. Owing to the great differences in day and night temperatures, it proved extremely difficult to maintain a proper degree of humidity in the breeding dishes and glass chimneys, and mortality of all stages of the sandflies was consequently high. One of the breeding dishes was found to harbour larvae of a fly of the genus *Scatopse*, which apparently destroyed those of *Phlebotomus*. In a few instances the adult sandflies were attacked by the mite, *Raphignathus youngi*, Hirst.

It also proved possible to breed sandflies in ordinary test tubes or small glass jars, but these are less convenient for observation purposes.

[Kaganova (B.) & Monchadskiĭ (A. S.).] **Каганова (Б.) и Мончадский (А. С.). On the Question of the Determination of the Instars and Age of the Larvae of Culicidae.** [*In Russian.*]—*Mag. Paras. Mus. zool. Acad. Sci. URSS.*, i, pp. 61–74, 2 graphs, 1 ref. Leningrad, 1930. [Recd. May 1932.] (With a Summary in German.)

In the course of observations on the development of larvae of *Anopheles maculipennis*, Mg., an attempt was made to find a reliable method of determining the instar and age of the larvae. Such knowledge would be of great practical value in anti-malaria campaigns, as the usual way of determining the age by the length of the body is very inaccurate and in many cases necessitates more frequent applications of larvicides than are required. Laboratory investigations showed that the chitinised tissues of the larva (head, stigmal plate, etc.), unlike the soft parts, hardly change in size in the course of an instar, having their maximum increase during moulting, and that by measuring the width of the head it is possible to determine the exact instar and age of a larva at any time. The technique of the process is described in detail, and tables and graphs are given showing the gradual changes in the dimensions of the head and prothorax of the larva of *A. maculipennis* that take place during the course of its development.

[KAZANTZEV (B. N.).] **Казанцев (Б. Н.). On the Question of the Variability in the Pattern and Colouration of the Wings of Mosquitos of the Genus** *Anopheles* **of Central Asia.** [*In Russian.*]—*Mag. Paras. Mus. zool. Acad. Sci. URSS.*, i, pp. 229–234, 2 pls., 4 refs. Leningrad, 1930. [Recd. May 1932.]

Examination of a number of females of *Anopheles pulcherrimus*, Theo., *A. superpictus*, Grassi, and *A. hyrcanus*, Pall., from various parts of central Asia showed that slight variations in the pattern and shades of the wings occur in individuals of the same species. In the case of *A. pulcherrimus*, it is not uncommon for the pattern on one wing of a single mosquito to differ from that on the other. In *A. superpictus* the pattern and colouration of the wings usually differ, and the author believes that the varieties of this species described in the literature, including *A. superpictus* var. *berestnevi*, Sching. [*R.A.E.*, B, xiv, 129], are not more than marked individual deviations. *A. hyrcanus* tends to vary considerably in the density of the colour of the wings, some individuals having very dark, almost black wings, while in others they are much lighter and of a brownish shade. Six specimens of this species showed a gradual change from the dark shades of the typical *A. hyrcanus* or *A. hyrcanus* var. *pseudopictus*, Grassi, to the light one of *A. hyrcanus* var. *mesopotamiae*, Christ. & Kazan Chand, indicating that there is no sufficient ground for considering individuals with lighter coloured wings to be a distinct variety.

[DOLBESHKIN (B. I.), GORITZKAYA (V. V.) & MITROFANOVA (Yu. G.).] **Долбешкин (Б. И.), Горицкая (В. В.) и Митрофанова (Ю. Г.). Description of a new Species of the Genus** *Aëdes* **(in sp.) from Eastern Europe.** [*In Russian.*]—*Mag. Paras. Mus. zool. Acad. Sci. URSS.*, i, pp. 253–260, 1 fig., 2 pls., 2 refs. Leningrad, 1930. [Recd. May 1932.] (With a Summary in German.)

Detailed descriptions are given of the larva and adult of *Aëdes rossicus*, sp. n., the adult being compared with those of *A. esoensis*, Yam. and *A. cinereus*, Mg. This mosquito, which closely resembles specimens of *A. esoensis* from the Ussuri region in the Russian Far East, has erroneously been recorded as the latter from Orenburg [*R.A.E.*, B, xvii, 24] and has since been found in central Ukraine, the northern Caucasus and as far north as Perm.

PAPERS NOTICED BY TITLE ONLY.

YAGI (N.). **Temperature Characteristics of Pulsation and Growth in Mosquito Pupae, as Basis for Determination of lower developmental Threshold Point.**—*Bull. Imp. Agric. Expt. Sta.*, iii, no. 3, pp. 213–216, 2 figs., 8 refs. Nishigahara, Tokyo, March 1932.

Riley (W. A.). **An annotated List of Canton, China, Mosquitoes, based on Collections by the late C. W. Howard.**—*Lingnan Sci. J.*, xi, no. 1, pp. 25–35, 19 refs. Canton, 30th March 1932.

Barraud (P. J.). **The Early Stages of some Indian Mosquitoes:** *Orthopodomyia.*—*Ind. J. Med. Res.*, xix, no. 4, pp. 1013–1017, 1 pl., 1 ref. Calcutta, April 1932.

Ghosh (B.). **Comparative Study of Larval Characters of** *A[nopheles] ludlowi* **(Theobald) and** *A. subpictus* **(Grassi).**—*Ind. J. Med. Res.*, xix, no. 4, pp. 1085–1090, 6 figs., 3 refs. Calcutta, April 1932.

Puri (I. M.). **Studies on Indian Simuliidae. Part III. Descriptions of Males, Females and Pupae of** *S[imulium] griseifrons* **Brunetti (1911) and of four new Species with striped Thorax** [*S. lineatum, S. barraudi, S. digitatum* **and** *S. dentatum*].—*Ind. J. Med. Res.*, xix, no. 4, pp. 1125–1143, 2 pls., 3 refs. Calcutta, April 1932.

Mühlens (P.). **Ueber Filarieninfektionen in Süd- und Mittelamerika, insbesondere** *Onchocerca caecutiens* **in Mexiko. (Sammelreferat.)** [The Types of Filariasis in South and Central America, with particular Reference to *O. caecutiens* in Mexico. A Review of the Literature.]—*Arch. Schiffs- u. Tropenhyg.*, xxxvi, no. 5, pp. 287–300. Leipzig, May 1932.

Kröber (O.). **Bemerkungen über die Systematik der neotropischen Tabaniden, nebst Bestimmungstabelle der Subfamilien und Gattungen (Dipt.).** [Notes on the Classification of Neotropical Tabanids, with Keys to the Subfamilies and Genera.]—*Rev. Ent.*, ii, no. 2, pp. 185–202, 6 figs. S. Paulo, 31st March 1932.

Symes (C. B.) & Roberts (J. I.). **A List of the Muscidae and Oestridae causing Myiasis in Man and Animals in Kenya, recorded at the Medical Research Laboratory, Nairobi.**—*E. Afr. Med. J.*, ix, no. 1, pp. 18–20. Nairobi, April 1932.

Schulze (P.). **2. Formenkreis Ixodides. Ixodoidea, Zecken.** [Keys to German Ixodoidea.]—*In* Brohmer *Fauna von Deutschland*, 4th edn., pp. 435–439, 14 figs., 5 refs. Berlin, May 1932.

[Pavlovskiĭ (E. N.) & Stein (A. K.).] **Павловский (Е. Н.) и Штейн (А. К.). Experimental Investigation on the Action of the Mite,** *Rhizoglyphus hyacinthi*, **producing a peculiar Form of Dermatitis in Man.** [*In Russian.*]—*Mag. Paras. Mus. zool. Acad. Sci. URSS.*, i, pp. 19–26. Leningrad, 1930. [Recd. May 1932.] (With a Summary in German.) [*Cf. R.A.E.*, B, xviii, 164.]

[Wagner (Yu. N.).] **Вагнер (Ю. Н.). Analytical Tables for the Identification of the Species of Aphaniptera living on Muridae.** [*In Russian.*]—*Mag. Paras. Mus. zool. Acad. Sci. URSS.*, i, pp. 97–192, 9 pls. Leningrad, 1930. [Recd. May 1932.]

Brindley (T. A.) & Richardson (C. H.). **Constant Temperature and Humidity Apparatus for Use in the Experimental Study of Insects.**—*Iowa St. Coll. J. Sci.*, v, no. 4, pp. 211–222, 3 pls., 2 refs. Ames, Iowa, 1931. [Recd. May 1932.]

Ross (G. R.). **Researches on Blackwater Fever in Southern Rhodesia.** —*Mem. Ser. Lond. Sch. Trop. Med.*, no. 6, vi + 262 pp., 24 charts, 1 map, 15 pp. refs. London, 1932. Price, cloth 10*s.* 6*d.*; paper, 8*s.*

A detailed report is given on investigations representing a continuation of research on blackwater fever in Southern Rhodesia conducted in 1922 and 1923 [*R.A.E.*, B, xiii, 61]. The distribution of the disease in the population and its incidence over a period of years have been carefully studied. The relationship existing between malaria and blackwater fever in Southern Rhodesia adds considerable weight to the argument that the latter disease is a manifestation of infection with malignant tertian. The greatest incidence of blackwater fever occurs in those classes of the population and in those areas in which the incidence of malaria is greatest, whereas freedom from malaria and blackwater fever coincide. The two diseases have the same seasonal incidence, and evidence of previous malarial infection exists in practically every case of blackwater fever. How far infection with other types of malaria can predispose to the development of blackwater fever cannot be determined from the information obtainable in Southern Rhodesia, where malignant tertian alone accounts for practically all cases of malaria seen.

Transmission by *Anopheles gambiae*, Giles, and *A. funestus*, Giles, of a hypothetical blackwater fever virus in addition to the malaria parasite would explain the absence of both diseases at the same time of the year, but would not account for the infrequency of blackwater fever in the first year of residence or its development at considerable intervals after removal from an endemic region, the immunity of the native inhabitant or the frequency with which an attack of malaria precedes its occurrence.

Earle (W. C.). **Notes on the Life History of *Anopheles albimanus* and *grabhami*.**—*Porto Rico J. Publ. Hlth. Trop. Med.*, vii, no. 3, pp. 381–384. San Juan, P.R., March 1932.

This paper records detailed observations on the life-history of *Anopheles albimanus*, Wied., the important vector of malaria in Porto Rico [*cf. R.A.E.*, B, xviii, 231], which were made during August and September when the temperature varied between 85·5 and 74·8°F., together with brief notes on *A. grabhami*, Theo. No eggs were laid on the night following a blood meal; the majority of females oviposited on the second or third night, and a few on the fourth or fifth. Oviposition was not observed before sunset, but apparently takes place at any hour during the night, being slightly more frequent before 10 p.m. On an average, 160 eggs were deposited by *A. albimanus* and 132 by *A. grabhami*. From 40 to 44 hours were required for incubation. Hatching occurred at any time of the day or night, but more frequently during the warmer hours; sunlight does not appear to be essential. The duration of development varied much more in the larva than in the egg or pupa; the minimum larval period was 4–5 days. Adults were never seen to emerge on the night following pupation, but large numbers may emerge on the second or third night. Emergence was not observed during the day; the most favourable time was apparently just after sunset.

Hoffman (W. A.), Marín (R. A.) & Burke (A. M. B.). **Filariasis in Porto Rico.**—*Porto Rico J. Publ. Hlth. Trop. Med.*, vii, no. 3, pp. 321–358, 4 pls., 19 refs. San Juan, P.R., March 1932.

A detailed account is given of investigations on the incidence of *Filaria* (*Wuchereria*) *bancrofti* in man in various localities in Porto Rico, with brief observations on the breeding and abundance of mosquitos, especially *Culex fatigans*, Wied., carried out between May 1927 and October 1928, but little further information of entomological interest is added to that in the preliminary report [*R.A.E.*, B, xvii, 115]. It is pointed out that as many of the steamships that come to San Juan anchor at Puerta de Tierra, an endemic centre of the disease, infection may be contracted during shore-leave. Moreover, annoyance by mosquitos is so pronounced on some of these ships that mosquito nets have been provided, and one of the authors has seen individuals of *C. fatigans* on board at least two days after departure from San Juan.

Soesilo (R.). *A. philippinensis* **en** *A. pallidus.*—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 8, p. 523. Batavia, April 1932.

With reference to a previous note on *Anopheles philippinensis*, Ludl., and *A. pallidus*, Theo. [*R.A.E.*, B, xx, 120], it is stated that larvae of both these species have been obtained in Djambi, Netherlands Indies.

Bonne-Wepster (J.) & Brug (S. L.). **The Subgenus** ***Stegomyia*** **in Netherland India.**—*Geneesk. Tijdschr. Ned.-Ind.*, Bijblad, no. 2, pp. 35–119, 22 figs., 6 pp. refs. Batavia, April 1932.

The mosquitos of the subgenus *Stegomyia* that occur in the Netherlands Indies are described, with notes in some cases on their biology. Details are given of the morphology, bionomics, natural enemies and control of *Aëdes* (*Stegomyia*) *argenteus*, Poir. (*fasciata*, F.) taken largely from the literature, and the relation of this mosquito, *A. albopictus*, Skuse, and *A. variegatus*, Dolesch., to the transmission of disease is briefly discussed. *A. variegatus* var. *alorensis*, n., is described from a single male from Alor, Lesser Sunda Islands.

Iyengar (M. O. T.) & Sarathy (M. K. P.). **A Constant Humidity Apparatus for Mosquitoes.**—*Ind. J. Med. Res.*, xix, no. 4, pp. 1091–1114, 2 figs. Calcutta, April 1932.

The authors describe an apparatus for maintaining mosquitos at constant humidities below saturation point, both at constant temperatures and at room temperature subject to daily variations, and at the same time providing them with water. The chamber in which the mosquitos are placed consists of a glass jar fitted with a lid having a bottle neck in which is inserted a Regnault's dew-point hygrometer. The chamber contains a block of wood or charcoal for the mosquitos to rest on, a watch glass with raisins for their food, a beaker of sulphuric acid covered with mosquito netting, and a flat-bottomed glass specimen tube of water fitted with a two-bore rubber stopper and two glass tubes, one of which reaches beneath the water and encloses a cotton wick. An equilibrium is established between the evaporation of the water and the absorption by the sulphuric acid, and the degree of humidity may then be varied by adjusting the wick higher or lower in the tube, or by increasing or decreasing the diameter of the beaker containing the sulphuric acid. For larger changes the concentration of the acid may be altered.

KHALIL (M.), HALAWANI (A.) & HILMY (I. S.). **On the Transmission of Filariasis Bancrofti in Egypt.**—*J. Egypt. Med. Ass.*, xv, no. 6, pp. 317–322, 2 refs. Cairo, June 1932.

In May 1931 investigations were begun in a village near Cairo to determine the vector of *Filaria bancrofti* in Egypt, where *Culex fatigans*, Wied., does not occur. Identification of several hundred mosquito larvae and adults showed that the majority were *Culex pipiens*, L., 12 per cent. were *Theobaldia longiareolata*, Macq., and one adult male bred from a larva was *Aëdes caspius*, Pall. The breeding-places were unused wells on the outskirts of the village (wells in constant use were always found to be free from larvae), except at the time of basin irrigation, from September to October, when the collection of the water in depressions of the land formed pools that yielded chiefly *Anopheles pharoensis*, Theo. In May the percentage of naturally infected individuals of *C. pipiens* was 5·7 (all the parasites being at the sausage-shaped stage in the thoracic muscles), and in October 20. All the adults captured were distended with blood, and the fact that they had not completed digestion explains to a certain extent the absence of infective filarial larvae. None of the adults of *T. longiareolata* showed any developing microfilariae, although a single parasite was seen in the stomach contents of one individual. In captivity this species could not be induced to feed, whereas the females of *C. pipiens* fed readily on cases of filariasis and all of them showed developing parasites when they were killed. The life-cycle of the parasite in the mosquito was found to vary with the temperature ; in September, when the average temperature was 29°C. [84·2°F.], the infective stage was reached in 14 days, whereas in November, when the temperature varied from 19 to 25°C. [66·2 to 77°F.], the larvae were still sausage-shaped after the same period. The microfilaria sheds its sheath and migrates from the stomach to the thoracic muscles in about 12 hours. The mature larva may make its way to the head and thence to the proboscis or occasionally to the palps, or it may be found first in the haemocoele. The process of development of the parasite in the mosquito at various temperatures is given in some detail.

ADLER (S.) & THEODOR (O.). **Investigations on Mediterranean Kala Azar. VI. Canine Visceral Leishmaniasis.**—*Proc. R. Soc.*, (B) cx, no. B 768, pp. 402–412, 2 pls., 20 refs. London, 2nd May 1932.

Eleven out of 100 dogs examined in Malta between June and November 1931 were found to be naturally infected with visceral leishmaniasis. Seborrhea and partial depilation, the most frequent signs of canine kala-azar, were found in nine out of the eleven. The histological changes in the skin can be briefly summarised as a selective infiltration of macrophages round hair follicles, including sebaceous glands, and the presence of infected macrophages in normal dermis. The latter phenomenon in the complete absence of secondary infiltration of round cells and plasma cells differentiates canine kala-azar from dermal leishmaniasis caused by *Leishmania tropica*, in which the infiltration of the macrophages is dense and not confined to the hair follicles, and the presence of infected macrophages in the dermis, particularly in the later stages, is always accompanied by considerable infiltration of plasma cells and small round cells. This differentiation is of no practical importance in the Mediterranean basin where natural infection of dogs with *L. tropica* is unknown, or in Mesopotamia where natural infections with *L. tropica* are common and canine kala-azar does not occur. It is, however, of the greatest importance in Turkestan where *Phlebotomus sergenti*, Parr., and *P. papatasii*, Scop. (carriers of oriental sore) and sandflies of the group of *P. major*, Ann., are common. The presence of these sandflies is believed by the authors to account for the fact that both cutaneous and visceral leishmaniasis are common in man and dog in Turkestan.

When females of *P. perniciosus*, Newst., were fed on three dogs infected with visceral leishmaniasis, 62·5 per cent. (90 per cent. in some tests) of those on the first dog became infected, 65·4 of those on the second, and 32 per cent. of those on the third.

Six individuals of *P. papatasii* fed on one of these dogs gave negative results. No infection was found in 13 fleas, *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., taken on the same dogs at the time high infection rates were found in sandflies, in spite of the fact that the flea feeds more frequently than *P. perniciosus*. This confirms previous evidence that *C. canis* is not concerned in the transmission of canine kala-azar. One flea was found to contain attached and free colonies of *Herpetomonas* (*Leptomonas*) *ctenocephali* in the hindgut and rectum. These flagellates are readily distinguished from *Leishmania* by their morphology and distribution. Negative results were also obtained when 4 females of *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) were fed on an infected dog and 30 on a heavily infected ground squirrel (*Citellus*). This is to be expected, as the intestinal tract of *A. argenteus* usually contains numerous bacteria. Twelve nymphs of *Rhipicephalus sanguineus*, Latr., dissected 6–14 days after feeding showed no signs of infection.

From the above observations it is concluded that a considerable proportion of sandflies (*P. perniciosus*) that feed on naturally infected and in some cases apparently healthy dogs becomes infected by ingesting skin juices. The visceral infections in the dogs examined were too slight to cause an invasion of the blood stream of sufficient intensity to induce an infection rate in *P. perniciosus* approaching that found in these experiments. Of 113 individuals of *P. perniciosus* fed on two cases of infantile kala-azar in Malta, none became infected. A very slight skin infection is sufficient to produce a considerable infection rate in sandflies. When the infection rate in *P. perniciosus* was about 90 per cent., the number of parasites in the skin of the dog was far less than in cases of oriental sore that gave an infection rate of 60 per cent. in *P. sergenti* and 13 per cent. in *P. papatasii*.

It is evident that the pathology of canine kala-azar is very different from that of infantile kala-azar. The visceral infection in dogs is less intense, although the changes in the liver, spleen, glands and bone marrow are of the same type. Skin infection is absent or negligible in human Mediterranean kala-azar, as shown by feeding experiments with *P. perniciosus*. This difference in pathology does not imply that the human and dog strains are different, for the human strain also produces skin infections in *Cricetulus griseus*, *Microtus guentheri* and *Citellus citellus*.

External skin changes have never been observed in dogs infected in the laboratory either with the human or dog strain, but this may be due to the fact that all recorded experimental infections have been produced by intraperitoneal or intrahepatic inoculation, whereas in nature infection occurs *via* the skin.

LANGERON (M.) & NITZULESCU (V.). **Révision des phlébotomes de France.**—*Ann. Paras. hum. comp.*, x, no. 3, pp. 286–294. Paris. 1st May 1932.

Since 1909, species of *Phlebotomus* have been recorded from various parts of France, but as the determinations were largely made before reliable specific characters for the females had been discovered [*R.A.E.*, B, xiv, 96], the authors have undertaken a critical revision based partly on sandflies in the Laboratory of Parasitology of the Faculty of Medecine of Paris and partly on specimens sent to them.

The following is taken from their conclusions : Contrary to general opinion *P. papatasii*, Scop., appears to be rare, as it has only been definitely recorded from one locality. *P. perniciosus*, Newst., is the most widely distributed species, *P. sergenti*, Parr., *P. parroti*, Adl. & Thdr., *P. ariasi*, Tonn., and *P. larroussei*, Lngn. & Nitzu., occurring in a few localities only.

DA COSTA LIMA (A.). **Sobre os phlebotomos americanos.** (**Diptera : Psychodidae.**)—*Mem. Inst. Oswaldo Cruz*, xxvi, fasc. 1, pp. 15–69, 28 pls., 6 pp. refs. Rio de Janeiro, 1932.

Various papers on the classification of *Phlebotomus* are reviewed, together with the results of an examination of some American species, in order to judge whether they can be classified according to the system adopted in the Old World. The material used consisted of dried or slide-mounted specimens. The females of nearly all the species examined are distinguishable by the spermathecae, and this character, together with the external morphology, especially of the palpi and wings, seems sufficient for specific identification in this sex. All the American species are then dealt with in order of date of description, notes being given on their distribution, characters and synonyms, with references to the literature. A key to the males is appended, based almost exclusively on the genitalia. The following new species are described, all from armadillo burrows in Brazil : *Phlebotomus nitzulescui* (previously confused with *P. brumpti*, Larrousse), *P. pintoi*, *P. avellari*, *P. brasiliensis*, *P. aragaoi*, *P. lutzianus*, *P. cavernicolus*, *P. fonsecai*, *P. singularis*, and *P. monticolus*. Other species dealt with include *P. cruciatus*, Coq. (*trinidadensis*, Newst.), *P. intermedius*, Lutz & Neiva (*mazzai*, Paterson, *neivai*, Pinto), *P. atroclavatus*, Knab (*tejeraae*, Larrousse), and *P. migonei*, França (*araozi*, Paterson & Shannon [but *cf. R.A.E.*, B, xx, 111]).

DIAS (E.). **O** *Trypanosoma cruzi* **póde evoluir na cavidade geral do** *Triatoma megista*. [*Trypanosoma cruzi* can develop in the Body-cavity of *Panstrongylus megistus*.]—*Mem. Inst. Oswaldo Cruz*, xxvi, fasc. 1, pp. 83–84, 1 pl. Rio de Janeiro, 1932.

Using a strain of *Trypanosoma cruzi* originally derived from armadillo in Brazil, but actually taken from a dog, injections were made into adults of *Panstrongylus* (*Triatoma*) *megistus*, Burm. The trypanosomes developed in the body-cavity, where their evolution was similar to that *in vitro*, and, partly, to their normal cycle in the digestive tract. The haemolymph of *P. megistus* does not, therefore, seem injurious to the various stages. No natural invasion of the body-cavity by this trypanosome has ever been observed by the author.

Hobson (R. P.). **Studies on the Nutrition of Blow-fly Larvae. II. Rôle of the Intestinal Flora in Digestion.**—*J. Exp. Biol.*, ix, no. 2, pp. 128–138, 1 fig., 14 refs. London, April 1932.

The following is the author's summary: The intestinal flora of *Lucilia* larvae consists mainly of non-lactose-fermenting, gram-negative bacilli, which do not liquefy gelatine. Proteolytic organisms are not present in the gut in significant numbers, but they occur in blown meat.

A method of rearing larvae aseptically is described. The eggs are sterilised by treatment with 0·1 per cent. mercuric chloride solution and the larvae reared on heated brain mush, sterility being tested by inoculating aerobic and anaerobic media. The absence of symbionts transmitted inside the egg has been concluded from an examination of stained smears and sections of "sterile" larvae. When larvae are reared aseptically on sterilised brain, the reaction of the gut contents is normal, tryptase is present in the intestine and excreta, and the growth rate is almost the same as in the presence of bacteria. It is therefore concluded that micro-organisms play no part in intestinal digestion.

Sterile larvae excrete ammonia, but the amount is insufficient to make the food alkaline until the third or fourth day of larval growth. With infected cultures the reaction is distinctly alkaline on the second day. The ammonifying bacilli isolated from normal larvae are probably responsible for the rapid appearance of ammonia in blown meat.

Mellanby (K.). **The Influence of Atmospheric Humidity on the Thermal Death Point of a number of Insects.**—*J. Exp. Biol.*, ix, no. 2, pp. 222–231, 5 figs., 11 refs. London, April 1932.

The following is the author's summary of experiments in which the insects used were *Xenopsylla cheopis*, Roths., *Pediculus humanus*, L. (*corporis*, DeG.), *Lucilia sericata*, Mg., and *Tenebrio molitor*, L. :—

An account is given of a technique suitable for exposing small insects to high temperature and air of controlled humidity. Data of survival points obtained from a number of species are given, for 1-hour and 24-hour experiments. In the 1-hour experiments, the humidity of the air had no effect on the death point, except in the case of large mealworms, which died at 1°C. [1·8°F.] higher in dry air than in moist. The temperature that any species can withstand for 1 hour is sharply defined, but there is a range of 7°C. [12·6°F.] between the species of insects investigated. In 24-hour experiments, in moist air, all the species died at between 36 and 39·5°C. [96·8–103·1°F.]. Their death was presumably caused by the heat. In dry air, those insects not able to conserve their water died at low temperatures (22°C. [71·6°F] in the case of flea larvae), this being attributed to desiccation.

There seem to be two main causes of death of insects when they are killed at high temperatures. At over 40°C. [104°F.], they die from the effects of the heat. Below 36°C. all the insects experimented with were able to survive at least 24 hours in moist air, but in dry air those unable to conserve their water may die of desiccation. In hot air, over 40°C., certain large insects are better able to survive in dry air, as they keep their bodies cool by evaporating water.

Fuller (M. E.). **The Larvae of the Australian Sheep Blowflies.**—*Proc. Linn. Soc. N.S.W.*, lvii, pt. 1–2, pp. 77–91, 22 figs., 10 refs. Sydney, 16th May 1932.

This paper provides a quick and satisfactory method of identifying the larvae of Australian sheep blow-flies. The following species have been recorded from live sheep and are arranged in order of succession, which is just as marked on the sheep as it is in carrion: Primary, *Lucilia cuprina*, Wied., and *L. sericata*, Mg. (of which the former is very much more common on live sheep), *Calliphora stygia*, F. (which appears to be replaced in Western Australia by *C. australis*, Boisd.), *C. augur*, F., and *C. fallax*, Hardy (one record only); Secondary, *Chrysomyia rufifacies*, Macq., *C. micropogon*, Big., *C.* (*Microcalliphora*) *varipes*, Macq., and *Sarcophaga* spp.; Tertiary, *Peronia rostrata*, R.-D., *Musca ventrosa*, Wied. (*hilli*, J. & B.), and *Ophyra nigra*, Wied. Descriptions of and a key to the full-grown third instar larvae of these species are given, with the exception of *M. ventrosa* of which no larval material was available. By the time the infestation is noticeable on a sheep in the field, the maggots are mostly in this stage, which is reached by the end of the second and on the third day on the living animal, or even sooner with some species in warm weather. A detailed description is given of the larva of *Calliphora stygia*, and the others are compared with it.

Ross (I. C.). **The Occurrence of Bot-fly Larvae** (*Gastrophilus veterinus*) **in Subcutaneous Tissues of the Horse.**—*Austr. Vet. J.*, viii, no. 1, pp. 34–35, 3 refs. Sydney, March 1932. (Reprinted in *Ind. Vet. J.*, viii, no. 4, p. 300. Madras, April 1932.)

Four larvae of *Gastrophilus nasalis*, L. (*veterinus*, Clark) are recorded from the subcutaneous tissues in the region of the hock of a crippled yearling foal in Western Australia, apparently firmly attached by their mouth parts. At the present time there is some doubt as to the manner in which hatching of the eggs of this species is brought about, and, as they are usually laid on the hairs of the cheeks and jowl of the horse where they are inaccessible to the animal's lips or tongue, it is not clear how the larvae gain the mouth [*cf. R.A.E.*, B, xx, 56]. The present finding indicates that the larvae may penetrate the skin, although the means by which they reach the stomach is not suggested, and in this case they appear to have followed an aberrant course.

Bissett (N.). **The Possible Association of the Sheep Nostril Fly** (*Oestrus ovis*) **with Pneumonia in Sheep.**—*Vet. J.*, lxxxviii, no. 5, pp. 220–223. London, May 1932.

A *post-mortem* examination undertaken during the investigation of an outbreak of pneumonia among sheep on a farm in Wales during May 1930 revealed the presence of an almost full-grown larva of *Oestrus ovis*, L., in blood-stained mucus at the bifurcation of the bronchi. A second larva was found in a subsidiary bronchus and eight were removed from the frontal sinuses. Examination of three more sheep from the same flock that had died of septic pneumonia of the lobar type showed no larvae in the bronchi or lungs, but 6, 12 and 14 were present in the respective frontal sinuses. Between May and June six similar outbreaks of pneumonia were investigated on widely separated farms. Twelve *post-mortem* examinations were made, and in seven, larvae measuring 4–10 mm. were found in the bronchioles. In the cases where no larvae were found, the pneumonia was of the septic and lobar type, whereas in the cases in which they were present, it was of the lobular or bronchial type (*i.e.*, not so far advanced). Two larvae occurred in all cases but one, in which only a single one was seen. From 6 to 23 larvae were found in the frontal sinuses in all cases, whether any were present in the lungs or not.

The author has periodically encountered outbreaks of ovine pneumonia during May and June for some years past without having been able to assign a definite cause. The records show that an exceptional mortality from the disease occurred during 1926, 1927 and 1930, following years when the sunshine was above normal for July and August, the time when the adult fly, which prefers sunny weather for the deposition of eggs and larvae, is on the wing. It is suggested that the larvae may be the cause of the disease. The fact that no larvae have previously been recorded from the lungs may be due to lack of observation, and possibly in cases of the septic and lobar type to their having become involved and destroyed in the inflammatory and septic processes. The fact that so few larvae were found does not preclude the possibility that more were originally present. In any case the presence of even one active larva living, feeding and excreting in the lung would be sufficient to set up a pneumonic process under ideal conditions for the eventual development of sepsis. In addition, all cases of this almost epidemic form of pneumonia in sheep recorded from 1923 to 1930 have occurred during April, May and June, when the larvae are migrating to the exterior. It is suggested that the finding of very small larvae (4 mm.) in the middle of June, when they should be almost full-grown, may be the result of paedogenesis, and their presence in the lungs and bronchi the result of an aberration of the migratory instinct on the part of the second larval generation.

Corson (J. F.). **The Results of successive Bites of an infected Tsetse Fly.**—*J. Trop. Med. Hyg.*, xxxv, no. 9, pp. 136–137, 1 ref. London, 2nd May 1932.

It has been observed that a tsetse-fly, especially if not very hungry, will insert its proboscis several times in different places before sucking blood, and about half the bites are not even felt. Moreover, when attacking groups of men, the fly is seen to pass from one individual to another, whether disturbed or not. Examination of the salivary glands of an infective fly usually shows them to contain numerous trypanosomes, and an experiment was undertaken to determine whether trypanosomes are injected at each bite or feed. An individual of *Glossina morsitans*, Westw., that had been infected with a strain of *Trypanosoma rhodesiense* was kept in a small wide-mouthed bottle closed with cotton mosquito gauze. The bottle was applied to the abdomens of white rats, as it had been previously noticed in the case of guineapigs that flies bite more frequently and feed less readily on the abdomen than on the back, perhaps owing to the thinness of the wall. After biting numbers of rats in succession, the fly fed on guineapigs. All the animals bitten during the fortnight of the experiment became infected, the experiment being terminated 49 days after the fly had last had an opportunity of feeding on an infected animal. It therefore seems that in nature tsetse-flies may cause many more infections than would be represented by the number of times they feed. The behaviour of infective flies may be so variable with regard to biting and feeding that the number of cases of sleeping sickness may have little relationship to the number of infective flies.

NÁJERA (L.). **Los vegetales insectivoros y la tripanosomiasis.** [Insectivorous Plants and Trypanosomiasis.]—*Med. Países cálidos*, v, no. 3, pp. 254–255. Madrid, May 1932.

Attention is drawn to an article by R. Barrera, in *La Voz de Fernando Póo* under the title " La destructora de la mosca Tsé-Tsé," which points out the attraction of *Melinis minutiflora* for species of *Glossina* and other flies, which are caught by the leaves and destroyed [*cf.* *R.A.E.*, B, x, 169].

MALLOCH (J. R.). **Exotic Muscaridae (Diptera) xxxvi.**—*Ann. Mag. Nat. Hist.*, (10) ix, nos. 52–54, pp. 377–405, 421–447, 501–518, 27 figs., refs. London, April–June 1932.

This paper deals with the classification and relationships of a large number of species of the Muscid subfamily STOMOXYDINAE. Keys are given to the genera and subgenera, to certain species (mainly African) of the genus *Stomoxys* and to the species of certain subgenera of *Bdellolarynx* and *Haematobia*.

As *Conops irritans*, L., the genotype of *Lyperosia*, Rond. (1856), had previously been designated by Westwood as the genotype of *Haematobia*, St. F. & Serv. (1828), the former genus is a synonym of the latter.

Stomoxys stimulans, Mg. (*irritans*, F., *nec* L.) is accepted as the genotype of *Haematobia*, R.-D. (1830) and was also designated as the genotype of *Lyperosiops*, a name proposed by Townsend (1912) as a substitute for *Lyperosia* of authors (*nec* Rond.). The genotype of *Bdellolarynx*, Aust. (1909) is *B. sanguinolentus*, Aust., which agrees closely in structure with *S. stimulans*, and as *Bdellolarynx* antedates *Lyperosiops*, the latter is used with *Haematobina*, subgen. n., to designate sub-genera of the former. As there appear to be no valid characters distinguishing *Haphospatha* from *Glossinella*, the former is regarded as a synonym of the latter, which is treated as a subgenus of *Haematobia*.

The new species described are *Stomoxys flavida* from Uganda, *S. neavei* from Nyasaland, *S. discalis* from North Borneo, *S. dubitalis* from Upper Perak, F.M.S., *Haematostoma* (gen. n.) *austeni* from North Borneo, *Neivamyia latifrons*, taken on horses in Peru and Brazil, *Bdellolarynx* (*Bdellolarynx*) *uniseriatus* from Southern Rhodesia and Zululand, *B.* (*Haematobina*) *latifrons* found on cattle in Nyasaland and also occurring in Zululand, *B.* (*H.*) *hirtifrons* from Kenya Colony, *B.* (*H.*) *angustifrons* from Zululand, *Haematobia* (*Haematobia*) *australis* (buffalo fly) from Australia, *H.* (*H.*) *spinigera* from Uganda (also on cattle in Nyasaland), and *Rhinomusca* (gen. n.) *brucei* from Kenya Colony. *Bruceomyia*, gen. n., is erected for *Lyperosia punctigera*, Aust.

Other species dealt with include *Haematobia* (*Glossinella*) *potans*, Bezzi (*Lyperosia pallidipes*, Roub.) and *Philaematomyia* (*Musca*) *crassirostris*, Stein, which is the only recognised species of its genus.

MONTEIRO (J. L.). **Estudos sobre a febre amarella. Modernos conhecimentos sobre a infecção experimental.** [Studies on Yellow Fever. Present-day Information on experimental Infection.] [*In Portuguese.*]—*Mem. Inst. Butantan*, v, pp. 49–170, 5 pls., 44 graphs, 220 refs. São Paulo, 1930. (With Summary in English.) [Recd. May 1932.]

This monograph, based on various experimental investigations carried out at the Butantan Institute, begins with a review of many recent observations on experimental yellow fever as derived from the fundamental work done by the American Commission in West Africa. It is divided into five chapters, the second dealing with the hosts and carriers of the virus and including a discussion of experiments on its transmission by mosquitos other than *Aëdes argenteus*, Poir. (*aegypti*, auct.) and by the excreta of the latter [*R.A.E.*, B, xvi, 236; xvii, 213; xviii, 166]. Several experiments are described in detail to show the possibility of the virus being also transmitted by the faeces of *Cimex lectularius*, L. [*cf.* xviii, 165]. Attempts have also been made to discover reservoirs of the virus among domestic animals. Preliminary experiments appeared to indicate that dogs may maintain it for a few days at least and cats for over a month.

BENARROCH (E. I.). **Estudios relativos al paludismo. VI. Metodos para el estudio del paludismo en Venezuela.** [Studies on Malaria. VI. Methods for studying Malaria in Venezuela.]—112 pp., illus. Caracas, Tipografia Americana, 1931. [Recd. June 1932.]

This book describes a method for malaria surveys specially prepared for Venezuela. It deals with blood and spleen examinations, mosquito surveys and dissection, etc. The Anophelines have already been recorded [*R.A.E.*, B, xvii, 108]. Keys to the larvae and adults are given, many characters being figured.

BLANK-WEISSBERG (S.). **Bedeutung der Temperaturextremen in der Oekologie und Biogeographie.** [The Part played by Extremes of Temperature in Ecology and Biogeography.] [*In German and Polish.*]—*Ann. Mus. zool. polon.*, ix, no. 19, pp. 287–302, 3 diag., 19 refs. Warsaw, 1st May 1932.

In connection with an anti-malaria campaign conducted in 1928 in the environs of Warsaw, 120 natural accumulations of water of various types were examined at intervals of 15 days from the beginning of May till mid-September, with a view to determining the effect of the air temperature on the prevalence of larvae of *Anopheles maculipennis*, Mg. The method employed is described. It was found that the abundance of the larvae depended on minimum and not on average temperatures. Thus, when the minimum temperature had dropped in the first half of June to 1·7°C. [35·06°F.], the number of larvae to a dip was reduced by 60 per cent. as compared with that when the minimum was 5·8°C. [42·44°F.], though the average temperature had meanwhile increased by 0·9°C. [1·62°F.]. In an instance observed in the second half of July, the number of larvae per dip increased in spite of a considerable fall in the average temperature. Fluctuations in maximum temperatures exercised no influence on the prevalence of the larvae. The increase in number of larvae per sample of water was strictly parallel to that of the minimum temperature up to 9°C. [48·2°F.], but above this point the increase in numbers was much more rapid than the rise of minimum temperature. It was not ascertained whether the influence of the temperature on the abundance of the larvae was due to its affecting the pairing of the adults, the number of eggs laid, or their hatching.

The second half of the paper is a discussion, partly based on the literature, on the part played by temperature extremes on the geographical distribution and activities of insects and other animals. The author believes these extremes to be much more important than average temperatures, and considers that in the tropics minimum temperatures make possible the development of animal life and maximum temperatures regulate abundance, the converse being true in temperate zones.

RILEY (W. A.) & WU LIANG-YU. **The Anopheline Mosquitoes of China.**—*Lingnan Sci. J.*, xi, no. 2, pp. 175–191, 13 figs., 24 refs. Canton, 15th May 1932.

After briefly reviewing the literature on the Anopheline mosquitos of China, the authors discuss the general characters distinguishing Anophelines and give a key to the females of the species known from China [*R.A.E.*, B, xv, 26; xvi, 217; xviii, 43], together with 6 additional species found in Indo-China [xv, 203], which may also be found in China, and *A. hyrcanus* var. *nigerrimus*, Giles, which probably occurs in South China, although as yet unreported. Notes are given on the collecting and rearing of mosquitos and the methods of handling specimens.

RILEY (W. A.). **The Ear Chigoe of Rats in China,** *Tunga caecigena* **J. and R.**—*Lingnan Sci. J.*, xi, no. 2, pp. 285–287, 5 refs. Canton, 15th May 1932.

Fleas causing nodules in the ears of rats at Soochow, China, have been identified as *Tunga caecigena*, J. & R. [*R.A.E.*, B, ix, 61], of which *T.* (*Dermatophilus*) *lagrangei*, Roub. [xiii, 138] is a synonym.

HOFFMANN (W. E.). **Notes on the Life History of** *Ranatra chinensis* **Mayr.**—*Proc. Nat. Hist. Soc. Fukien Christian Univ.*, iii, pp. 31–36, 1 pl., 1 ref. Shanghai, August 1930. [Recd. June 1932.]

A detailed account is given of the life-history of the Nepid, *Ranatra chinensis*, Mayr, the nymphs and adults of which destroy large numbers of mosquito larvae in China.

WALCH (E. W.). **Het verband tusschen de voorkeur van Nederlandsch-Indische Anophelinen voor menschen- of dierenbloed en haar gevaarlijkheid (Tweede mededeeling).** [The Relation between the Preference of Netherlands Indian Anophelines for Human or Animal Blood and their Dangerousness (Second Communication).]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 11, pp. 682–709, 20 refs. Batavia, May 1932. (With a Summary in English.)

In continuation of previous work on the relation between the feeding habits of various Anophelines in the Netherlands Indies and their importance as vectors of malaria [*R.A.E.*, B, xvi, 215], the blood in the stomachs of females captured in stables or in houses was subjected to the precipitin test. Nearly all those in stables containing fresh blood had fed on animals. Of the engorged mosquitos caught in houses the percentage containing human blood was taken as an indication of the preference of the species for feeding on man. *Anopheles ludlowi*, Theo., which is the most dangerous malaria vector in the Netherlands Indies, and *A. hyrcanus* var. *sinensis*, Wied., which is the chief vector inland in southern Sumatra, had percentages of 86 and 83 respectively. Other species feeding readily on man were *A. leucosphyrus*, Dön., a proved carrier in Sumatra; *A. punctulatus*, Dön., the most dangerous species in the Moluccas; and *A. umbrosus*, Theo., the most important vector in the interior of western Borneo. *A. subpictus*, Grassi (*rossi*, Giles) and *A. aconitus*, Dön., which are known to be of secondary importance, appeared to feed less readily on man; while *A. vagus*, Dön., and *A. tessellatus*, Theo., which are harmless, did so least of all. *A. maculatus*, Theo., *A. kochi*, Dön., and *A. fuliginosus*, Giles, belong to a large group of zoophilic species, their definite position requiring further investigation. Despite the correlation between malaria transmission and preference for human blood, the latter factor is not the only one explaining why certain species are carriers and others not. Very different experimental infection rates have been found.

It was also attempted to ascertain whether the fact that a species dangerous in one place may be harmless in another might be due in some instances to differences in the abundance of cattle. It was found that even where cattle are abundant *A. ludlowi* and *A. hyrcanus* var. *sinensis* show a high percentage of engorged females with human blood, and where cattle are scarce *A. leucosphyrus*, *A. maculatus* and *A. aconitus* also do so. The figures for *A. aconitus* suggest that it becomes a dangerous vector in areas where it is not diverted to animals. Under such circumstances severe malaria, caused chiefly by *A. aconitus*, which has an infection rate of 3·5 per cent., has been recorded. The introduction of cattle would probably tend to reduce the incidence of the disease.

GREEN (R.). **A Malarial Parasite of Malayan Monkeys and its Development in Anopheline Mosquitoes.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxv, no. 6, pp. 455–477, 2 pls., 7 figs., 33 refs. London, 14th May 1932.

This is a detailed account of an investigation of a malarial parasite of *Macacus cynomolgus*, the common Malayan macaque, a preliminary note on which has already been noticed [*R.A.E.*, B, xix, 163]. The sexual and asexual phases of the parasite, which has now been identified as *Plasmodium inui*, are dealt with at length. It has also been found in the race of this monkey imported from Java, and a different form of malarial parasite in the Malayan *M. nemestrina*. In addition to the mosquitos used in the experiments previously noticed, later experiments deal with *Anopheles philippinensis*, Ludl., which takes blood from man and monkeys with equal readiness, and *A. aconitus*, Dön., but neither showed infection of glands or midgut when dissected after being fed on inoculated monkeys. It is suggested that, whereas domestic animals have been shown to bring about dissociation of Anopheline mosquitos from man, the proximity of monkeys or apes, by providing anthropoid blood, may tend to favour association of Anophelines with man. *A. maculatus*, Theo., was observed to be more inclined to take blood from man and monkeys than the other Anophelines tested.

Attempts to infect monkeys by injections of sporozoites of *P. inui* or *P. falciparum* were unsuccessful. The preliminary injection of approximately 55,000 sporozoites of *P. falciparum* did not affect the course of malaria in a monkey that was inoculated later, by injection of blood, with its own form of parasite. An injection of human blood containing *P. vivax* failed to infect a monkey and afforded some evidence of host-parasite specificity. The similarity in morphology and development of *P. inui* of monkeys and *P. vivax* of man is discussed with regard to the possibility of cross infection with plasmodia occurring between man and members of other primate families, and to the difficulties arising in interpretation of dissection results, when infected Anophelines are found in districts in which they have had access to both monkeys and man infected with malaria.

HARLEY (G. W.). **A Theory regarding the Rôle of Insect Saliva in Filarial Periodicity.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxv, no. 6, pp. 487–491, 14 refs. London, 14th May 1932.

The following is the author's abstract : The hypothesis is presented that there is a positive specific chemiotaxis acting on microfilariae to cause them to migrate toward the saliva of the insect host, and that this same substance may furnish the stimulus for cyclical parturition of the adult filaria.

The bite of a hyperfilariated *Culex fatigans*, Wied., may be a factor in initiating certain attacks of lymphangitis in Porto Rico showing a lunar periodicity.

CRAIG (C. F.). **The possible Chemotactic Effect of the Salivary Secretions of certain Insects upon Microfilariae.**—*Science*, lxxv, no. 1952, pp. 561–562, 1 ref. New York, 27th May 1932.

In a recent report on *Onchocerca* investigations in Guatemala, Strong stated that three species of the genus *Simulium* (*Eusimulium*) are concerned in the transmission of *O. caecutiens* and that if one of these flies " is allowed to bite on the face of an infected individual there are found on examination of the blood in the abdomen many more microfilariae than are encountered in the direct examination of the skin, but, in a case where a previous examination of a section of the skin of the face has shown no microfilariae, if a second section is made through or very near the spot where a fly has just bitten, very large numbers of microfilariae (over one hundred) may be found in it. Very clearly the fly usually produces in some way during feeding a concentration of the microfilariae about the point of the bite, many of which it imbibes." A similar phenomenon was observed by the author and Ashburn during their investigations of the development of the microfilariae of *Filaria bancrofti* (*philippinensis*) in the Philippines during 1907, blood ingested by *Culex fatigans*, Wied. (*quinquefasciatus*, Say) containing many more microfilariae than could be found in approximately the same amount of blood obtained from the patient. This phenomenon, so far as is known, has not been confirmed by other workers, but it would appear to merit further study. It is possible that it also occurs in other cases in which parasites are transmitted by blood-sucking insects.

Colombo (U.). **Activité de l'équipe antilarvaire de la Brigade d'Assainissement d'Elisabethville pendant les six premiers mois de son fonctionnement. (Février à juillet 1931.)**—*Ann. Soc. belge Méd trop.*, xii, no. 2, pp. 113–131. Brussels, June 1932.

An account is given of the organisation and activities of the new section for work against mosquito larvae of the Sanitation Service of Elisabethville, Belgian Congo, from February to July 1931. The mosquitos encountered included *Anopheles gambiae*, Giles (*costalis*, Theo.), *A. maculipalpis*, Giles, *A. squamosus*, Theo., *A. mauritianus*, Grp., and *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.). Details are given of the breeding-places of each species. A total of approximately 28,000 empty receptacles that were possible breeding-places were collected during this period.

Barber (M. A.), Rice (J. B.) & Brown (J. Y.). **Malaria Studies on the Firestone Rubber Plantation in Liberia, West Africa.**—*Amer. J. Hyg.*, xv, no. 3, pp. 601–633, 2 graphs, 1 map, 11 refs. Baltimore, Md., May 1932.

This paper records the results of an investigation carried out from February to May 1931 on part of a rubber plantation in Liberia. The Anopheline density as measured by the average daily catch per room was 7·6 for February, 6·2 for March, and 7·0 for April, but in May during a period of almost daily rains it rose to approximately 9·0. A list of the Anophelines encountered has already been noticed [*R.A.E.*, B, xx, 97]. Only *Anopheles gambiae*, Giles (*costalis*, Theo.), *A. funestus*, Giles, *A. nili*, Theo., and *A. theileri* var. *hancocki*, Edw., were common in dwellings. Dissections of large numbers of the first two species yielded total malaria infection rates of 4·3 and 3 per cent. and sporozoite rates of 3·5 and 1·9 per cent., respectively. The number of stomach dissections of *A. nili* was too small to give a reliable index of total infection, but the sporozoite rate was 0·8 per cent. No positive results were obtained with the small number of *A. theileri* var. *hancocki* dissected. The character of the population and the incidence of malaria in the various camps studied is briefly discussed. An experiment with stained individuals of *A. gambiae* and *A. funestus* showed that there was a fairly free dispersal of the former, and possibly also of the latter, within a radius of nearly half a mile, and it is probable that these species range over a still greater area. The inhabitants of certain camps and houses were treated with plasmochin between 5th March and 3rd April, 1 cgm. being administered twice a week with no harmful results. The effect was measured by determining the sporozoite rate in Anophelines caught in dwellings at intervals of 10 days. There was a marked drop in the sporozoite index 10–15 days after the beginning of the treatment (this being the approximate time required for the maturation of oöcysts), and it remained below that of the controls until about 14 days after the treatment was discontinued. Twenty days after the last dose of plasmochin had been administered, the sporozoite index of the combined treated camps had equalled or exceeded that of the controls. The presence of a few infected mosquitos in the camps during treatment was probably due to their migration from untreated parts of the plantation. An experiment on a gametocyte carrier showed that after one dose of 2 cgm. plasmochin this man failed to infect mosquitos even though crescents were present in his blood for at least a week afterwards. It is suggested that a larger experiment be made to ascertain whether treatment with plasmochin would be a practical anti-malarial measure on this plantation.

In the second part of the paper, the breeding-places of the various Anophelines are discussed, and it is concluded that the terrain favours the continuous production of large numbers. A comparison of wooded and cleared portions of the same streams appeared to show that clearing increased the breeding of Anophelines, particularly the chief malaria vectors, *A. gambiae* and *A. funestus*. A survey of an older plantation indicated that re-growth of vegetation reduced Anopheline production but that there was still sufficient breeding of *A. gambiae* to maintain a high malaria rate. Allowing the re-growth of jungle beside streams would only be of value if breeding in pools in villages were also controlled. Drainage at the present time would only be practical for the protection of a limited area. From a rough estimate of the percentage of older mosquitos and mosquitos containing sporozoites, it is concluded that no reduction in their incidence was made by daily collections, and that replacements after collections may include large numbers of older mosquitos, some of which may come from considerable distances. On the other hand, there was no general intermingling of the Anopheline population, since a study of the species incidence in the various camps clearly indicated a tendency to localisation within the area of the camp.

SHANNON (R. C.). *Anopheles gambiae* **in Brazil.**—*Amer. J. Hyg.*, xv, no. 3, pp. 634–663, 2 figs., 4 maps, 22 refs. Baltimore, Md., May 1932.

Anopheles gambiae, Giles, was first discovered in Natal, Brazil, in March 1930 [*R.A.E.*, B, xviii, 150, 275]. During April–June a severe outbreak of malaria occurred in the vicinity of the breeding area in the city, and dissections showed that numbers of this mosquito were infected [xix, 188]. A more extended investigation covering the coastal area from Recife, Pernambuco, to Bélem, Pará, made to determine whether it had extended its range, indicated that it was still restricted to Natal. The survey was, however, undertaken during the middle of the dry season (December 1930–January 1931), and in view of the fact that in Africa the species disappears more or less completely during the dry season, its absence from the other localities may have been more apparent than real. On the other hand, the very limited supply of water existing in the region made the search for larvae comparatively simple, and it may therefore be stated that if *A. gambiae* existed outside Natal it did so in very limited numbers. The literature on its habits in Africa is briefly reviewed. In Natal, it was found to breed apparently exclusively in small, shallow collections of seepage and surface springs (fed by superficial seepage), usually fully exposed to the sun, whereas the native Anophelines were usually taken in ponds, streams and marsh waters, where natural enemies were numerous. This fact appears to indicate a fundamental biological difference between the African and native Brazilian species and also to suggest that *A. gambiae* is unable to adapt itself to the presence of indigenous predators. Observations in Africa indicate that at the beginning of the rainy season it breeds in every collection of water and increases rapidly in numbers. This apparently took place in

Brazil in 1931 for in June it was reported from a locality 112 miles from Natal and in September from various other localities, all of which were, however, within a radius of 120 miles [xx, 78]. The Anopheline breeding-places found in Natal are enumerated, and notes are given on possible breeding-places in the other towns and cities investigated. The general characteristics of north-eastern Brazil are briefly reviewed, and data from the literature on the relation of *A. gambiae* to rainfall in various parts of Africa are given and compared with conditions existing in Brazil. The fact that typical seepage outcrops were found only in Natal and Parahyba indicates that they are rare in the region as a whole. It seems probable that if *A. gambiae* succeeded in extending its range, there would be large areas in which it could not permanently establish itself and therefore its distribution would tend to be highly localised ; it would probably occur chiefly in towns and cities, which are usually situated in the vicinity of permanent water supplies. Regions of higher rainfall and more prolonged wet seasons occur in the northern coastal States (Maranhao and Pará) and in certain localities south of northern Bahia, and should *A. gambiae* be introduced into these areas, it would probably find more permanent breeding-places.

HUFF (C. G.). **Further Infectivity Experiments with Mosquitoes and Bird Malaria.**—*Amer. J. Hyg.*, xv, no. 3, pp. 751–754, 12 refs. Baltimore, Md., May 1932.

The four species of *Plasmodium, P. praecox* (*relictum*), *P. cathemerium, P. elongatum* and *P. rouxi,* that cause avian malaria are very briefly described. *P. rouxi,* obtained from the Pasteur Institute, Algeria, was found to be infective to *Culex tarsalis,* Coq. (9·3 per cent.), *C. pipiens,* L. (5·1 per cent.), and *C. territans,* Wlk. (8·3 per cent.), but not to *C. salinarius,* Coq., or *C. fatigans,* Wied. (*quinquefasciatus,* Say). In tests with the other three species of parasite and *C. tarsalis,* 83·3, 42·8 and 16·6 per cent. respectively of the mosquitos became infected. Four individuals of *C. tarsalis* were fed on a bird heavily infected with *P. praecox,* and two of them transmitted the infection when fed on a healthy bird 12 days later. As *C. tarsalis* is widely distributed and has been found to feed very readily on birds, it is probably of considerable importance in the transmission of bird malaria in North America.

HINMAN (E. H.). **Notes on Louisiana** *Culicoides*—(**Diptera Ceratopogoninae**).—*Amer. J. Hyg.*, xv, no. 3, pp. 773–776, 3 refs. Baltimore, Md., May 1932.

Notes are given on the habits of *Culicoides mississippiensis,* Hoffman, *C. guttipennis,* Coq., and *C. furens,* Poey, which are recorded for the first time from Louisiana. Larvae and pupae of *C. guttipennis* were found in a tree hole in a live oak (*Quercus virginiana*) in association with those of *Anopheles quadrimaculatus,* Say.

ROOT (F. M.). **The pleural Hairs of American Anopheline Larvae.**—*Amer. J. Hyg.*, xv, no. 3, pp. 777–784, 14 figs., 4 refs. Baltimore, Md., May 1932.

The author investigated the pleural hairs of the thorax of American Anopheline larvae with a view to evaluating their use as a diagnostic character [*cf. R.A.E.*, B, xvii, 31]. He concludes that in the subgenera *Anopheles* and *Nyssorhynchus* they are not so valuable for grouping species as they have been shown to be in the subgenus *Myzomyia*. The long pleural hairs are of much the same form throughout the whole American series of *Anopheles*, such variations as occur being, in general, of specific rather than group value. This fact serves to emphasise further the comparatively close relationship between the subgenera *Anopheles* and *Nyssorhynchus*, and the more isolated and specialised condition of the subgenus *Myzomyia*. On the other hand, the three long metathoracic pleural hairs of *Chagasia* and the spinose pleural hairs of the subgenus *Stethomyia* differ from anything reported for other Anopheline larvae and serve to confirm their comparatively isolated position. In actual field identification, the only probable use of pleural hair characters is in the differentiation of species of the *Arribalzagia* group. In this group, distinguishing characters for the larvae are so difficult to find that the discovery that in about half the species the long anterior dorsal prothoracic pleural hair is split, whereas in the others it is single, may be of some value.

KERR (J. A.) & HAYNE (T. B.). **On the Transfer of Yellow Fever Virus from Female to Male** *Aëdes aegypti*.—*Amer. J. Trop. Med.*, xii, no 3, pp. 255–261, 3 refs. Baltimore, Md., May 1932.

In the experiments described, males of *Aëdes argenteus*, Poir. (*aegypti*, auct.) were kept for periods varying from 1 to 9 days with females infected with yellow fever at different intervals beforehand, and in one case with infected females that had just fed on a normal monkey (*Macacus rhesus*). Infectivity tests made by inoculating suspensions of freshly killed males into monkeys 1–32 days later gave no evidence that any of the males contained the virus. Immunity tests on the inoculated monkeys confirmed these results. These experiments, considered together with those of other workers [*R.A.E.*, B, xvii, 237 ; xix, 110, 210], indicate that only rarely is the virus transferred from infected females to males, and it therefore appears that the direct transfer of the virus from mosquito to mosquito is of no importance in the epidemiology of yellow fever.

HINMAN (E. H.). **The Rôle of Solutes and Colloids in the Nutrition of Anopheline Larvae. Preliminary Report.**—*Amer. J. Trop. Med.*, xii, no. 3, pp. 263–271, 8 refs. Baltimore, Md., May 1932.

An account is given of further experiments on the use of materials in suspension and solution in breeding waters as food for mosquito larvae [*cf. R.A.E.*, B, xviii, 233]. Hexyl resorcinol was found to be more satisfactory than calcium hypochlorite as a disinfectant for mosquito eggs, which were immersed for two minutes in a 1 : 1,000 solution in 70 parts water and 30 parts glycerin. The mosquitos employed were *Anopheles crucians*, Wied., and *A. quadrimaculatus*, Say, and the water used was taken from their normal breeding-places. Larvae of both species were able to live up to eleven days and to make significant growth under sterile conditions in water passed through a Seitz-Werke filter to remove all microscopic organisms such as bacteria, yeasts, etc. Certain colloids having large molecules are also eliminated by this process, so that only the other colloids and the true solutes were left in the water. In water from which everything but the true solutes had been removed, the larvae hatched within the normal period, but died promptly (99 per cent. within the first 72 hours) and showed no significant growth. When colloids with small molecules alone were present the eggs hatched in normal time and the larvae lived up to 6 days under sterile conditions, making a slight growth during this time but in no case reaching the second instar. Their early death may possibly be due to the absence of solutes, which, although unable by themselves to support life, may be necessary for the normal development of the larvae.

Bradley (G. H.). **Some Factors associated with the Breeding of** *Anopheles* **Mosquitoes.**—*J. Agric. Res.*, xliv, no. 5, pp. 381–399, 6 figs., 7 refs. Washington, D.C., 1st March 1932.

Observations on Anopheline larvae in the lakes, bayous [*R.A.E.*, B, xii, 96] and sloughs (land-locked and stagnant branches of the bayous) in the delta region of Louisiana in the vicinity of Mound were made during the period from May to September in 1928 and 1929, in an attempt to determine what factors influence the increase and decrease in their numbers. The following is taken from the author's summary :—

Protection from *Gambusia affinis* and other natural enemies is provided by floating vegetable débris and by various species of plants, the most effective being small débris and filamentous algae. Waters containing filamentous blue-green algae in the absence of filamentous green algae were not very favourable for larvae. *Lemna* affords some protection, but when it forms a complete mat over the water surface it almost completely inhibits the breeding of *Anopheles*.

Larval abundance, as measured by the number of larvae occurring in collections of 10 dips of surface water, was not greatly affected by variations in the mean summer air temperatures, which in each month were above 70°F. Under certain conditions, a rapid decrease in surface water was found to reduce the number of larvae by stranding protective material. As a rule larger numbers of plankton organisms occurred in the non-breeding areas. This is explained in part by the fact that breeding waters are usually more shaded and the surface is covered to a greater extent by vegetation and débris, a condition that results in the development of fewer chlorophyll-bearing organisms. The character of the plankton in Anopheline breeding and non-breeding areas varied considerably, but no consistent variations in composition between the two groups was found, nor were any consistent differences observed between waters containing large and small numbers of larvae. The four commonest genera of flagellate protozoa composed approximately the same percentage of the total flagellates in each group of waters.

The range of hydrogen-ion concentration in breeding and non-breeding areas was found to be essentially the same, and all groups of waters were principally alkaline in reaction. The mean of the readings in an unshaded, impounded bayou was, however, higher than that in the breeding areas (8·01 as against 7·42).

Examinations of the gut contents of larvae showed that all organisms of suitable size are likely to be ingested, but that some available forms are present in the gut less often than others. This may have been due to the fact that the preferred habitat of these organisms does not coincide with that in which the larvae feed, or it may be that the amount of maceration that the softer-bodied organisms undergo greatly reduces the possibility of their being recognised.

Grant (H. G.), Newman (B. M.) & Wood (P. D.). **The Action of colloidal Paris Green on the Larvae of** *Culex apicalis*. **A preliminary Report.**—*Publ. Hlth. Rep.*, xlvii, no. 23, pp. 1239–1247, 3 refs. Washington, D.C., 3rd June 1932.

In view of the success attained with Paris green in killing larvae of Anophelines, attempts have been made to extend its use as a larvicide to Culicines, particularly as it has been shown to be toxic to such larvae if it can be made to reach them [*R.A.E.*, B, xvi, 65]. It was thought that colloidal Paris green, homogeneously distributed through the water, might accomplish this, and laboratory experiments were accordingly undertaken at Richmond, Virginia, in 1931 to test several colloidal preparations of Paris green against larvae of *Culex apicalis*, Adams. Details are given of the experiments and of the methods of preparing the colloids. It was found that colloidal Paris green is toxic in as small concentrations as 1 part by weight of Paris green to 5,000,000 parts by weight of water. Colloidal preparations made from a solution of Paris green in concentrated ammonium hydroxide (NH_4OH) gave better results than the other preparations used, killing all larvae placed in dilutions of 1 : 5,000,000 within periods ranging from 19 hours to 3 days. It seems possible that colloidal Paris green can be developed as an effective and comparatively inexpensive mosquito larvicide, and further experiments are in progress.

Roubaud (E.). **Des phénomènes d'histolyse larvaire postnymphale et d'alimentation imaginale autotrophe chez le moustique commun** *Culex pipiens*.—*C. R. Acad. Sci. Fr.*, cxciv, no. 4, pp. 389–391. Paris, 1932.

The author considers that the fat-body in hibernating females of *Culex pipiens*, L., is not derived, as has been previously supposed, from the sugar or blood meal taken by the mosquito in the adult stage, but that it is elaborated from the histolysed muscular masses of the larval abdomen. After emerging from the pupae, females that hibernate are as thin as those that do not, but if they are isolated in a damp atmosphere at a temperature below 20°C. [68°F.] without nourishment other than pure water, the fat-body is apparent after 12 days and continues to develop during the first month of hibernation. The neutral fats of the fat-body are consumed very slowly, and the hibernating individuals can subsist on water for 4–5 months without taking any nourishment. The autotrophic fattening of the females is only possible if the larvae from which they originate are well nourished. In active females the same phenomenon occurs, but the muscular material in this case passes to the eggs and enables the female to lay one batch without a blood meal [*R.A.E.*, B, xix, 215]. Again this is only possible when the larvae have accumulated a mass of reserve material, and for females from under-nourished larvae a blood-meal is necessary before oviposition can take place.

Although the process of autogenous reproduction appears at present to be exceptional in the normal biology of blood-sucking mosquitos, the phenomena of autotrophy, which characterise the spontaneous winter fattening, seem to have a much more general application as an interpretation of the hibernating life of these insects.

Ginsburg (J. M.). **Airplane Oiling to control Mosquitoes.**—*Science*, lxxv, no. 1951, p. 542, 4 refs. New York, 20th May 1932.

Since in the swamps and marshes of New Jersey, where the larvae of the prevailing mosquitos are primarily bottom feeders, control by arsenical or other dust is either ineffective or not practicable, experiments were carried out during the summer of 1931 to determine the possibility of applying oil or other liquid larvicides by means of an aeroplane. Two 50 U.S. gal. tanks were installed in the forward cockpit and connected to a steel pipe, 3 inches in diameter, extending along the bottom of the fuselage and terminating just below the rudder in a cross pipe, 7 feet long and 1½ inches in diameter, perforated with holes, ⅛–¼ inch in diameter, from which the liquid flows. A valve, placed at the rear end of the longitudinal pipe and operated by the pilot, controls the flow of oil. The aeroplane flies as low as possible, and the liquid flows out as a fine spray, depositing a thin film over the breeding areas. By this method both pyrethrum larvicide and oil were tested. The results showed that on a still day a killing film is deposited. In two areas, practically complete kill of larvae and pupae was obtained. About 8 acres of a meadow were covered with a killing film of oil in about 40 minutes, the amount required for this being about 140 U.S. gals., and the cost of the application less than that of hand oiling.

Kopstein (F.). **De verspreiding van** ***Xenopsylla astia*** **op Java en haar beteekenis voor de epidemiologie der bubonenpest.** [The Distribution of *X. astia* in Java and its Importance for the Epidemiology of Bubonic Plague.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 10, pp. 618–633, 2 maps, 41 refs. Batavia, 10th May 1932.

The literature on the relation of *Xenopsylla astia*, Roths., to bubonic plague is reviewed. This flea is restricted to the north coast of Java, where it occurs with *X. cheopis*, Roths., on the indoor rodent fauna of three species of rats and a shrew, *Pachyura murina*. Out of doors it was taken once only, on a rat. On the north coast plague occurs in some ports and not in others. It has not been recorded from the south coast, though the only rat-fleas there are *X. cheopis*. The small outbreaks in the ports of Java are quite unimportant compared with the epidemics in the hill and mountain districts and are tending to vanish. The reasons for this relative immunity of the coast are unknown.

Warble Fly Experiments. An Account of Experiments conducted by Assistant Agricultural Overseers and County Agricultural Instructors and at Albert Agricultural College and Department's Agricultural Schools.—*J. Dept. Agric.* [*Ireland*], xxxi, no. 1, pp. 12–41. Dublin, 1932.

Details are given of a number of experiments carried out at various localities in Ireland during 1930 and 1931 to test the value of several derris preparations against warble-flies [*Hypoderma*] in the backs of cattle. It was found that by systematic application of certain dressings 90–100 per cent. of the larvae can be killed. The first dressings should be applied not later than about the middle of March and in some districts as early as 1st March. The number of dressings depends on whether the warbles continue to appear late in the season. In many cases three applications at intervals of 28–30 days are sufficient, but in some cases a fourth may be necessary. The experiments indicated that even if a certain number of larvae survive the effects of one dressing, their development is so retarded that a large proportion of them will still be present at the time of the next, and in this way the probability of their ultimately being killed is greatly increased. The washes may be applied with a piece of cloth after brushing the back of the animal to remove scabs and pus material and expose the warbles. When the warbles are few, each one may be treated, but when they are numerous it is advisable to apply the wash all over the back, neck and flanks. Even when the wash is used liberally all over the back, one gallon should be sufficient to treat at least a dozen animals.

A wash consisting of ½ lb. derris powder and ¼ lb. soft soap in 1 gal. water is most highly recommended, but two derris powder preparations in which soap is incorporated gave satisfactory results and have the advantage of being rather more easy to prepare. These two powders should be used at the rate of ¾ lb. to 1 gal. water. All the washes should be continually stirred to keep the powder in suspension. The efficiency of a derris ointment was also proved, but treatment with this preparation is tedious and would not be practical on a large scale.

KÜRSCHNER (—). **Die Bekämpfung der Dasselfliege.** [The Control of the Warble-fly.]—*Münch. tierärztl Wschr.*, lxxxii, no. 20, pp. 241–245. Munich, 13th May 1931.

STIEFENHOFER (G.). **Versuche zur Bekämpfung der Dasselfliege im Frühjahr 1931.** [Experiments in the Control of the Warble-fly in the Spring of 1931.]—*T.c.*, no. 29, pp. 349–355, 1 fig. 15th July 1931.

ZAUBZER (T.). **Die diesjährige Durchführung von Dasselbekämpfungsversuchen im Ostallgäu und der Stand der Dasselfliegenbekämpfung in Dänemark (1930).** [The Experiments in Warble-fly Control carried out in the Ostallgäu District of Bavaria in 1931, and the Position of Control in Denmark in 1930.]—*T.c.*, no. 37, pp. 445–451. 9th September 1931.

KÜRSCHNER (—). **Die Bekämpfung der Dasselfliege.** [The Control of the Warble-fly.]—*T.c.*, no. 43, pp. 519–522, 2 figs. 21st October 1931.

The first paper is a report of the proceedings at the 6th meeting on warble-fly [*Hypoderma*] control held in March 1931 at the German Ministry of Agriculture to discuss the value of various measures. It was stated that infestations only occur in certain regions of Germany, and that various larvicidal substances, including derris, are available, while mechanical removal can also be resorted to. The question of propaganda or, alternatively, compulsory measures, was also considered.

The second paper records the results of experiments in the mountain districts of Bavaria with various proprietary preparations and with mechanical extraction of the larvae. The former did not prove satisfactory, but the latter gave results of value in practice. A needle, with the point bent over to form a small hook and mounted in a wooden handle, is pushed into the orifice of the warble with the flat side towards the larva. It is then turned so that the point enters the larva, which is drawn out sufficiently to enable it to be removed with a pair of forceps.

The third paper records more or less satisfactory tests with proprietary preparations, and continued success with the " N-P " (needle and pincer) method. The account of the position of warble control in Denmark in 1930 is based on Danish reports. Mechanical removal has given better results than any other method, including " Hypodermol," a largely used salve containing paradichlorobenzene, derris and laurel oil.

The last paper is the report of a meeting in September 1931 where the work done in 1931 was discussed. Three insecticidal preparations and mechanical removal were stated to be satisfactory. Methods of conducting propaganda were debated.

Peter (B.). **Die staatlichen Versuche zur Bekämpfung der Dasselfliege im Jahre 1931.** [Official Experiments in combating the Warble-fly in 1931.]—*Berlin. tierärztl. Wschr.*, xlvii, no. 41, pp. 665–667. Berlin, 9th October 1931.

Peter (B.). **Resistenz der Dasselfliegenlarven gegen Delicia IV und gegen Larfug.** [The Resistance of Warble-fly Larvae to Delicia IV and to Larfug.]—*T.c.*, no. 50, pp. 809–811. 11th December 1931.

In 1931 work on uniform lines was undertaken under Government auspices against warble-flies [*Hypoderma*] in Germany. The various preparations tried are discussed, the author's view being that a larvicidal ointment is best for practical reasons. Mechanical removal with needle and forceps is not suited to the thin-skinned cattle of North Germany.

The second paper describes experiments with two proprietary larvicides of which one, an ointment, rubbed for 1 minute into the skin of 4 animals produced larval mortalities of 100, 97·95, 89·65, and 100 per cent. respectively. The needle and forceps method cannot be used when the warbles are still small and the injury to the hide has not become serious.

Henry (M.) & Gurney (W. B.). **The Buffalo Fly.** (*Lyperosia exigua* **de Meijere.**)—*Agric. Gaz. N.S.W.*, xliii, pt. 5, pp. 329–335, 2 figs. Sydney, 1st May 1932.

An account is given of the situation in Australia as regards *Haematobia* (*Lyperosia*) *exigua*, de Meij., much of the information on its bionomics and distribution being taken from the literature. It is usually considered that an annual rainfall of 20 ins. is the minimum that this fly can tolerate [*R.A.E.*, B, xx, 46], but on the coast of Western Australia it has been found at places having one of 10 ins., and there is the possibility of its being carried through a belt of comparatively low rainfall to areas further south in which the rainfall is heavier. In view of the success obtained by spraying cattle prior to shipment [xx, 85], it is considered that by treating the animals at railway termini and again during the journey, and also by removing the manure at an approved centre, the spread of the fly may be retarded. Control would be facilitated by limiting the number of routes by which cattle may be transported. The most effective method for prevention of spread would be the establishment of a buffer area of perhaps 30 miles wide, fenced on both sides and kept free from stock.

GRAU (H.). **Fremdkörper und Parasiten in den Tonsillarkrypten des Pferdes.** [Foreign Bodies and Parasites in the tonsillar Cavities of the Horse.]—*Berlin. tierärztl. Wschr.*, xlvii, no. 48, pp. 779–780, 1 fig., 7 refs. Berlin, 27th November 1931.

Three mature larvae of *Rhinoestrus purpureus*, Brauer, are recorded from the tonsillar cavities of a horse slaughtered at Leipzig. Some published records of the occurrence in the throat of animals of larvae of *Oestrus, Gastrophilus* and *Hypoderma* are cited.

CAMERON (A. E.). **Arthropod Parasites of the Red Deer** (*Cervus elaphus* **L.**) **in Scotland.**—*Proc. Roy. Phys. Soc. Edinb.*, xxii, no. 2, pp. 81–89, 12 refs. Edinburgh, May 1932.

An account is given of the life-histories of *Hypoderma diana*, Br., *Cephenomyia auribarbis*, Mg., *Trichodectes cervi*, L., and *Lipoptena cervi*, L., all parasites of the red deer in Scotland, and of the tick *Ixodes ricinus*, L., of which the red deer is one of the numerous hosts.

CAMERON (A. E.). **The Nasal Bot Fly,** *Cephenomyia auribarbis* **Meigen (Diptera, Tachinidae) of the Red Deer,** *Cervus elaphus* **L.**—*Parasitology*, xxiv, no. 2, pp. 185–195, 3 figs., 14 refs. Cambridge, 22nd June 1932.

Cephenomyia auribarbis, Mg., a parasite of the red deer, is distributed throughout the deer forests of Scotland. The adult is on the wing during June and July. The larva normally occurs attached to the walls of the nasal passages and pharynx, where it remains for 10–11 months. At maturity it drops to the ground and pupates beneath the surface, the adult emerging in 3–4 weeks. In January 1931 a third instar larva was found in fat in the pelvic region of a stag, and the possible means by which it could have reached this position are discussed. The adult female and the early third stage larva are described and illustrated, and the cephalo-pharyngeal apparatus of *C. auribarbis*, *Oestrus* (*Cephalomyia*) *ovis*, L., and *Gastrophilus intestinalis*, DeG., are compared.

GATER (B. A. R.). **Malayan Trombidiid Larvae, Part I. (Acarina : Trombidiidae) with Descriptions of seventeen new Species.**—*Parasitology*, xxiv, no. 2, pp. 143–174, 16 figs., 51 refs. Cambridge, 22nd June 1932.

A systematic survey of the ectoparasites of rats in Malaya was carried out during 17 months in 1929 and 1930. About half of the 1,200 rats examined were obtained from the town of Kuala Lumpur and the others from an estate and jungle area, including the oil palm estate on which cases of scrub typhus and tsutsugamushi disease have occurred [*R.A.E.*, B, xvii, 185 ; xix, 97]. Over a period of nearly 4 months, 538 examinations of labourers on this estate were carried out, and 87 Trombidiid larvae belonging to three species, *Trombicula akamushi*, Brumpt, *T. deliensis*, Walch, and *T. hirsti*, Samb., were found on them. In another district, *T. acuscutellaris*, Walch, was found attacking man. These species are also parasitic on rats. In view of the importance of mites as parasites and vectors of disease, the author deals in this paper with the classification of 24 species (of which 17 are described as new) found on rats, but points out that some or all of the larval forms discussed may prove to have been previously described as adults.

PAPERS NOTICED BY TITLE ONLY.

HALL (M. C.). **Parasites and Parasitic Diseases of Sheep.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1330, revd. edn., 45 pp., 34 figs., 4 refs. Washington, D.C., January 1932. [*Cf. R.A.E.*, B, xviii, 160, etc.]

ELLENBERGER (W. P.) & CHAPIN (R. M.). **Cattle-Fever Ticks** [*Boophilus annulatus*, Say] **and Methods of Eradication.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1057, revd. edn., 27 pp., 9 figs. Washington, D.C., January 1932. [*Cf. R.A.E.*, B, xii, 4.]

MOHLER (J. R.). **Tick Fever** [Piroplasmosis of Cattle transmitted by *Boophilus annulatus*, Say].—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1625, 29 pp., 5 figs. Washington, D.C., February 1932. [See *R.A.E.*, B, xviii, 276.]

SCHULZE (P.). **Neue und wenig bekannte Arten der Zeckengattungen** *Amblyomma* **und** *Aponomma*. [New and little known Species of the Tick Genera *Amblyomma* and *Aponomma*.]—*Z. Parasitenk.*, iv, no. 3, pp. 459–476, 10 figs., 10 refs. Berlin, 18th May 1932.

RILEY (W. A.). **Dyar's Canton Species of** *Aëdes* **Mosquitoes.**—*Lingnan Sci. J.*, xi, no. 2, pp. 283–285, 5 refs. Canton, 15th May 1932. [*Cf. R.A.E.*, B, xx, 156.]

MACGREGOR (M.E.). **The Ova of** *Aëdes* (*Finlaya*) *geniculatus* **Olivier.**—*Parasitology*, xxiv, no. 2, pp. 183–184. Cambridge, 22nd June 1932.

MARTINI (E.). *Chagasia fajardoi* **Lutz var.** *stigmopteryx*, **nov. var.** [in Brazil] (**Dipt. Culicidae**).—*Rev. Ent.*, ii, fasc. 3, pp. 276–277. S. Paulo, 10th May 1932.

KRÖBER (O.). **Die Tabaniden-Subfamilie Bellardiinae End. (Dipt.) der neotropischen Region.**—*Rev. Ent.*, ii, fasc. 3, pp. 289–302, 6 figs. S. Paulo, 10th May 1932.

GIL COLLADO (J.). **Notas sobre Pupíparos de España y Marruecos del Museo de Madrid (Dipt. Pupip.).** [Notes on Diptera Pupipara of Spain and Morocco in the Madrid Museum.]—*Eos*, viii, no. 1, pp. 29–41, 2 figs., 18 refs. Madrid, 30th April 1932.

BLANCHARD (L.) & DINULESCU (G.). **Le métabolisme glucidique chez la larve de gastrophile.**—*C. R. Soc. Biol.*, cx, no. 20, pp. 340–342, 1 graph, 6 refs. Paris, 10th June 1932.

BLANCHARD (L.) & DINULESCU (G.). **Le métabolisme glucidique chez les larves de gastrophiles au cours de l'inanition et de l'anaérobiose.**—*C. R. Soc. Biol.*, cx, no. 20, pp. 343–344, 1 graph. Paris, 10th June 1932.

MICHAL (K.). **Die Beziehung der Populationsdichte zum Lebensoptimum und Einfluss des Lebensoptimums auf das Zahlenverhältnis der Geschlechter bei Mehlwurm und Stubenfliege.** [The Relation of Density of Population to the Optimum and Influence of the Optimum on the Sex Ratio in *Tenebrio molitor*, L., and *Musca domestica*, L.]—*Biol. Generalis*, vii, no. 3, pp. 631–646, 2 figs., 11 refs. Vienna, 1931.

BACK (E. A.) & COTTON (R. T.). **Hydrocyanic Acid Gas as a Fumigant for destroying Household Insects.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1670, 20 pp., 20 figs. Washington, D.C., April 1932. [See *R.A.E.*, A, xx, 467.]

Lewis (E. A.). **Some Tick Investigations in Kenya Colony.**—*Parasitology*, xxiv, no. 2, pp. 175–182, 11 refs. Cambridge, 22nd June 1932.

As little is definitely known of the species of ticks in Kenya or of their potentialities for conveying disease, the author gives the results of observations and studies on the life-history and distribution of the following species that are commonly found in the Colony: *Rhipicephalus pulchellus*, Gerst., *R. simus*, Koch, *Hyalomma aegyptium*, L., *Haemaphysalis aciculifer*, Warb., and *Amblyomma variegatum*, F. Details of the life-cycle of the ticks when reared on hares (or in the case of *A. variegatum* on hares, fowls and sheep) are given. Attempts to feed larvae of *R. pulchellus* on calves and sheep were unsuccessful, and although specimens have been taken from cattle, sheep, goats, pigs, horses, dogs and man, they are much more often found on wild animals such as zebra, buffalo, etc. *R. simus* has been taken on dogs, sheep, cattle and many wild animals, and is exceptionally common on rats and in rats' nests. *H. aegyptium* has been taken from cattle, sheep, goats and many wild animals, and it seems probable that the hare (*Lepus capensis crawshayi*) is one of the natural hosts for the immature stages. *H. aciculifer* has only once been taken on a domestic animal (a goat). *A. variegatum*, which is common, has been proved to transmit heartwater to sheep and cattle [*R.A.E.*, B, xviii, 220] in the adult stage. Nymphs and adults are commonly found on domestic stock, etc., and larvae have been taken from wild birds.

Leeson (H. S.). **The Effect of Temperature and Humidity upon the Survival of certain unfed Rat Fleas.**—*Parasitology*, xxiv, no. 2, pp. 196–209, 4 charts, 17 refs. Cambridge, 22nd June 1932.

The following is taken from the author's summary: The experimental technique used in previous work on the effect of temperature and humidity upon the survival of unfed fleas is criticised. In the present investigations measures have been taken to eliminate as many variables as possible, the methods employed being described.

A total of 2,027 *Xenopsylla cheopis*, Roths., 999 *X. astia*, Roths., and 646 *Ceratophyllus fasciatus*, Bosc, were used, all unfed and less than 24 hours old at the beginning of the different experiments. Records were kept individually so that a statistical measure of consistency could be made.

It is concluded that the duration of life in unfed fleas is not influenced by sex. High temperatures and low humidities tend to shorten life and, conversely, low temperatures and high humidities, with a possible optimum of about 90 per cent., tend to prolong it. Humidity is at its maximum efficiency in this respect at about 18°C. [64·4°F.]. At 37°C. [98·6°F.] humidity ceases to have any effect upon the duration of life of the unfed fleas, and the evidence suggests that there is also a low temperature at which humidity ceases to influence survival. There is no direct proportion between survival of unfed fleas and saturation deficiency of the atmosphere at any temperature. *C. fasciatus* lived longer than the other two species of fleas under similar atmospheric conditions, and *X. astia* longer than *X. cheopis* at all humidities at 23°C. [73·4°F.].

Hoare (C. A.). **On Protozoal Blood Parasites collected in Uganda. With an Account of the Life-cycle of the Crocodile Haemogregarine.**—*Parasitology*, xxiv, no. 2, pp. 210–224, 56 figs., 17 refs. Cambridge, 22nd June 1932.

In the course of experiments on the transmission of the crocodile trypanosome by *Glossina palpalis*, R.-D., laboratory bred flies were fed on a crocodile infected with *Trypanosoma grayi* and *Haemogregarina pettiti*. In one of these flies, dissected 20 days later, structures were found in the body cavity that closely resembled the haemogregarine described by Chatton and Roubaud [*R.A.E.*, B, i, 121] and by Macfie [v, 46]. The suspicion of these authors that the crocodile is the vertebrate host of this parasite is confirmed by the present observations, as the fly could not have acquired its infection from any other source. The stages of development of the parasite, which are described, agree in all essentials with those observed by the previous authors, the type of sporogony being peculiar to representatives of the genus *Hepatozoon*, to which it should be referred. It is well known that the crocodile spends part of the day on land lying motionless with its mouth open. If the tsetse-fly settles in the mouth to feed, the crocodile, irritated by its bites, may snap its jaws and crush the fly, thus liberating the cysts of the haemogregarine in the buccal cavity.

Caminopetros (J.). **La réaction scrotale du cobaye provoquée par l'inoculation des tiques** (*Rhipicephalus sanguineus*) **infectées avec le virus de la fièvre boutonneuse.**—*C. R. Soc. Biol.*, cx, no. 20, pp. 344–346, 2 refs. Paris, 10th June 1932.

The non-susceptibility of guineapigs to infection with Marseilles fever when inoculated with the blood of infected persons distinguished this disease from Rocky Mountain spotted fever, which it resembled in many other points. However, guineapigs inoculated with suspensions of ticks (*Rhipicephalus sanguineus*, Latr.) from dogs in known infected quarters of Piraeus and Volo showed, in every case, reactions similar to those produced by Rocky Mountain spotted fever. Smears from the tunica vaginalis revealed numerous rickettsiae, both extracellular and within the endothelial cells. The negative results obtained on inoculation from man may be explained by the low degree of virulence of the blood.

Dove (W. E.) & Shelmire (B.). **Some Observations on Tropical Rat Mites and Endemic Typhus.**—*J. Parasit.*, xviii, pp. 159–168, 5 pls., 11 refs. Urbana, Ill., 1932.

The clinical symptoms of endemic typhus in Texas both in man and laboratory animals are discussed. The authors' work on the transmission of the disease by *Liponyssus bacoti*, Hirst [*R.A.E.*, B, xix, 178; xx, 49], and the studies of other workers on the relation to it of other ectoparasites of rats are briefly reviewed. It was found that 72 per cent. of the cases of endemic typhus worked where foodstuffs were handled or stored, thus coming into contact with the habitats of rats and mice. In contrast to the ordinary form of typhus in the Old World, 84 per cent. of the cases occurred between May and

December, the warmer months in north-eastern Texas. The distribution of *L. bacoti* is discussed, and it is suggested that collections of the mite made during the seasonal prevalence of the disease would show that the incidences of the two are closely correlated.

The collection of mites is not easy even in localities where they are known to occur. They do not remain on the rats, but seek cracks and crevices in buildings in which to moult or oviposit. All stages are attracted by the heat of hot water pipes or lighted stoves as well as by the body temperature of man ; for this reason a light should be used in collecting and the search confined to warm places, particularly the vicinity of hot water pipes and the facings of the woodwork. The mites may be transferred to tubes by means of a camel's-hair brush. They may also be collected on a rat or guineapig by exposing it in situations where they are likely to be or introducing it into a paper bag in which rats' nests have been kept sealed for a few days. Collections of engorged mites from these animals should be made at frequent intervals, for they are clumsy in crawling when just engorged and therefore are easily transferred to tubes; moreover they are difficult to find when they begin once more to seek shelter.

The mites depend entirely on blood for food, and at least 4 blood meals are necessary for the completion of the life-cycle, which under favourable conditions may take only 12 days. Under such conditions engorgement of the different stages occurs at intervals of about 3 days, and they may easily become infected from a rat with septicaemia lasting 3 or more days. Newly-born rats undoubtedly remain in the nests long enough to be bitten by infected mites, and when they leave the nest they take numbers of larvae with them and also leave the nest infested with infected mites of various stages to feed on other rats or warm-blooded animals. A concentration of mites is thus obtained in nests and in other places visited by rats. In grocery stores, where cases of endemic typhus occur, water draining from ice chests seems to attract large numbers of rats.

MARÇON (—) & AUDOYE (—). **Au sujet de quelques cas de typhus endémique observés à bord du cuirassé Paris.**—*Bull. Soc. Path. exot.*, xxv, no. 5, pp. 390–396, 9 refs. Paris, 1932.

The authors discuss seven cases of endemic typhus that occurred in a battleship at Salins d'Hyères, near Toulon, during the winter of 1931–32. These cases coincided with the presence in the ship's rats of an infection that produced in guineapigs symptoms similar to those of Mexican typhus. Three out of four rats were infected, and as these rodents come into frequent contact with man, it is thought that the infection was transmitted by their ectoparasites [*R.A.E.*, B, **xx**, 133].

ROUBAUD (E.) & GASCHEN (H.). **Concurrence larvaire et peuplements anophéliens.**—*Bull. Soc. Path. exot.*, xxv, no. 5, pp. 428–431, 1 fig., 4 refs. Paris, 1932.

Experiments with larvae of *Anopheles maculipennis*, Mg., of different ages in waters with restricted surface areas confirmed the theory that larvae from eggs laid first develop at the expense of the younger larvae, which either die or are considerably retarded in their development [*R.A.E.*, B, xvi, 210].

Birk (W.). **Die Uebertragung des Paratyphus Breslau durch die** *Stomoxys calcitrans*. [The Transmission of Paratyphus Breslau by *S. calcitrans*.]—*Zbl. Bakt.* (1 Orig.), cxxiv, no. 5–6, pp. 280–300, 15 figs., 16 refs. Jena, 6th May 1932.

Experiments here described in great detail with a strain of paratyphoid that is particularly pathogenic to mice and is of some importance in human pathology proved that *Stomoxys calcitrans*, L., is capable of transmitting the bacillus by biting. Transmission occurred up to 14 days after the infecting feed. It is therefore possible that various varieties of paratyphoid and also typhoid can be carried by this fly, which might convey paratyphoid bacilli from man to animals and from them, after slaughtering, back to man. The majority of unexplained cases of paratyphoid and typhoid in Germany, particularly in country districts, occur in late summer and autumn, and transmission by *Stomoxys* may be the explanation.

Regendanz (P.) & Reichenow (E.). **Beitrag zur Uebertragungsweise von** *Babesia canis* **durch Zecken.** [A Contribution regarding the Method of Transmission of *Piroplasma canis* by Ticks.]—*Zbl. Bakt.* (1 Orig.), cxxiv, no. 7–8, pp. 471–478, 10 refs. Jena, 10th June 1932.

Previous work on the transmission of *Piroplasma* (*Babesia*) *canis* by ticks is briefly reviewed. In the experiments described adults of *Rhipicephalus sanguineus*, Latr., that were descendants of ticks from Java were fed on infected dogs and then kept for oviposition. Emulsions of the resultant eggs, larvae and nymphs failed to infect, as did also larvae and adults of both sexes when allowed to feed. In another experiment adults of *Rhipicephalus* were fed on dogs infected by subinoculations from one that had been fatally infected by *Dermacentor reticulatus*, F., but their offspring (nymphs and adults) failed to transmit infection. As other workers have obtained transmission by *R. sanguineus*, it is supposed that various races of *P. canis* exist differentiated solely by their adaptation to different species of ticks. Experiments were also made to ascertain in which stage the progeny of *D. reticulatus* become infective after the adults have fed on blood infected with *P. canis*. No infection was obtained with larvae, but nymphs proved capable of transmission, which contradicts Brumpt's results [*R.A.E.*, B, viii, 41, 67]. Microscopic examination of the salivary glands showed that all adults are infective, but not all nymphs. An experiment in which females kept for two months at 9°C. [48·2°F] after a meal of infected blood produced infective offspring indicated that hibernation does not affect the infection in the tick.

Regendanz (P.) & Reichenow (E.). **Beitrag zur Kenntnis von** *Bartonella canis*. [A Contribution to the Knowledge of *B. canis*.]—*Arch. Schiffs- u. Tropenhyg.*, xxxvi, no. 6, pp. 305–322, 34 figs., 17 refs. Leipzig, June 1932.

A portion of this paper deals with the problem of transmission of *Bartonella canis*. No spontaneous infection of ticks was observed, and negative results were obtained by injecting suspensions of eggs, larvae, nymphs and adults of *Rhipicephalus sanguineus*, Latr., that were the offspring of ticks fed on infected dogs. Adults of *Dermacentor reticulatus*, F., fed as nymphs on an infected dog, failed to transmit infection by biting. The infections in the dogs of the laboratory at Hamburg pointed to the presence of some blood-sucking vector. Winged insects were unlikely to have been concerned, the animal quarters being especially free from *Stomoxys*. Fleas were the only ectoparasites on the dogs, no lice being found. Fleas fed on an infected dog were placed on a healthy one and their excreta were injected into another animal, but no infection resulted. To test the possibility of mechanical carriage, a suspension of fleas that had fed on an infected dog was injected twice with a 3-day interval, and infection was produced. It would seem that infected fleas on a healthy dog may be bitten by the latter and their infected intestinal contents may thus be released and enter lesions in its skin. Experiments with bed-bugs [*Cimex lectularius*, L.] proved negative.

THIRY (G.), RICHARD (P.) & DOMBRAY (P.). **A propos d'un cas de pseudo-parasitisme de** *Geophilus longicornis* **Leach 1814 chez l'homme.**—*C. R. Soc. Biol.*, cx, no. 22, pp. 611–613. Paris, 27th June 1932.

A case is recorded from France in which a woman who had an almost continuous cough and had had a heavy cold in the head for several weeks coughed up a living example of *Geophilus longicornis*, Leach. As the symptoms disappeared after the expulsion of the Myriapod, it is thought that they were due to its presence and that it must consequently have been in the respiratory tract for some weeks. The means by which it could have attained this position and the possible manner in which the symptoms were induced are discussed.

RIVNAY (E.). **The Influence of Relative Humidity upon the Rate of Development of the Bed Bug** *C. lectularius* **L.**—*Bull. Soc. roy. ent. Egypte*, xvi, fasc. 1–2, pp. 13–16, 6 refs. Cairo, 1932.

In order to determine the influence of humidity on the rate of development of blood-sucking insects, experiments were undertaken with the bed-bug, *Cimex lectularius*, L., using several humidities and different temperatures and feeding the bugs only once during each moulting period. As the differences in the lengths of the instars were not very marked or constant, it is concluded that relative humidity probably has no effect on the rate of development. This is explained by the fact that the food contains much water. As the food-supply diminishes, the influence of humidity becomes more noticeable. Preliminary experiments with starving bugs showed that the higher the temperature and the lower the humidity, the more rapidly they die.

AUTUORI (M.). **Contribuição para o estudo biologico de** *Eutriatoma flavida* **(Neiva).** [A Contribution to the biological Study of *E. flavida*.]—*Rev. Ent.*, ii, fasc. 3, pp. 269–275, 6 figs., 7 refs. S. Paulo, 10th May 1932.

An account is given of breeding experiments at S. Paulo, Brazil, with larvae of *Eutriatoma flavida*, Neiva, received from Cuba, where it is, however, so rarely found that its occurrence in dwellings is apparently accidental. The only first-stage larva received moulted 5 times: on 2nd September 1928 and then after intervals of 52, 36, 70, and 272 days. The resultant female mated and, after 97 days, oviposited. Further eggs to a total of 19 were laid at intervals of

2–11 days. Only one of all the eggs resulting from this and other individuals hatched, conditions in the laboratory being probably quite different to those in nature.

BEQUAERT (J.). **The Tabanidae of the American Museum Congo Expedition, 1909–1915.**—*Amer. Mus. Nov.*, no. 539, 19 pp., 1 fig. New York, 15th June 1932.

This paper includes a list of 26 species of Tabanids, of which a large proportion were males, found in the Belgian Congo among the prey of the Sphegid, *Bembex bequaerti* var. *dira*, Arnold.

BEQUAERT (J.). *Paederus signaticornis* **Sharp, the Cause of vesicular Dermatitis in Guatemala (Coleoptera: Staphylinidae).**—*Bull. Brooklyn Ent. Soc.*, xxvii, no. 2, pp. 107–112. Brooklyn, N.Y., 1932.

Cases of vesicular dermatitis in man in Guatemala have been found to be due to *Paederus signaticornis*, Sharp. A list is given of the 10 species of *Paederus* that are known to cause dermatitis in nature, and the literature on them is briefly reviewed.

SALT (G.). **The natural Control of the Sheep Blowfly,** *Lucilia sericata*, **Meigen.**—*Bull. Ent. Res.*, xxiii, pt. 2, pp. 235–245, 2 figs., 13 refs. London, July 1932.

In the course of an investigation instituted with a view to developing a satisfactory large-scale method of rearing *Alysia manducator*, Panz., a laboratory study of the reproductive rate of *Lucilia sericata*, Mg., was carried out during 1931. The technique employed is fully described. It was observed that females failed to develop eggs when restricted to a carbohydrate diet [*cf. R.A.E.*, B, xvii, 100], but a female that had been fed on meat produced fertile eggs at the end of 15 days although mated with a male fed only on carbohydrates. Light was found to be essential for reproduction. Eggs of *L. sericata* must be kept wet throughout manipulation to prevent them from sticking to anything they touch. Counted groups of eggs were arranged on a cover slip, the excess moisture drained off with blotting paper, and the cover slip placed on the surface of a piece of meat. The egg stage at 22°C. [71·6°F.] lasts 20 hours, and the young larvae crawl from the cover slip to the meat. Larvae were reared on minced lean beef, about 50 gms. placed in a glass dish $2\frac{3}{4}$ inches in diameter and $1\frac{1}{4}$ deep being ample for rearing 200–300. The dish was embedded in the surface of clean, dry, sifted sand, placed to a depth of 5 inches in a large jar, which was covered with a cloth top held in place by an elastic band and kept in an incubator at 71·6°F. The larvae leave the meat on the seventh day when fully fed, and after crawling about on the surface of the sand for some hours enter it to pupate. Pupation occurs about the tenth or eleventh day. Puparia were obtained on the fifteenth day by sifting the sand, and were placed in tins or isolated in vials for emergence, which at 71·6°F. occurs on the twentieth or twenty-first day after the eggs are laid. Emerged flies may be lightly anaesthetised with ether for examination, but should not be exposed to chloroform, from which they do not appear to recover normally. Adults kept in cages in a greenhouse at a temperature of 18–28°C. [64·4–82·4°F.] and supplied with sugar, split raisins, meat and water lived for over three months, the average duration of life for the first and third generations being 41 days for males and 55·6 for females, with maxima of 68 and 104 respectively. Eggs were usually first laid on the seventh day, but sometimes as early as the fifth, after emergence. Fertile eggs were obtained from a female 66 days old, and one female laid 202 eggs on her 91st day though these were all sterile. In captivity, with meat always available, females are capable of laying nearly 2,000 eggs, and allowing for all losses the potential reproductive rate of one pair of flies is estimated at 1,000. An account of experiments carried out to ascertain the number and weight of larvae obtained when different numbers of eggs were placed on equal portions of meat and notes on the natural control of *L. sericata* have already been noticed [xviii, 98.].

Previous work in rearing *A. manducator* is reviewed [xv, 82 ; xvii, 118] and the results compared with those obtained by the author. The author considers that this Braconid is the best known parasite of blowflies because it acts at the optimum time, parasitising the larvae when they are almost full-grown, after environmental factors and over-blowing have effected their heaviest reduction in the numbers of the larvae. Parasites such as the Cynipids, *Figites anthomyiarum*, Bch., and *Kleidotoma marshalli*, Mshl. [*cf.* xvi, 197] that attack the larvae in their early stages are far less effective because a very large proportion of the larvae they destroy would die in any case. *Mormoniella vitripennis*, Wlk. (*brevicornis*, Ashm.) and other parasites of the pupa are effective but fail in control because only a small proportion of the puparia is accessible to them. Since the numbers of *L. sericata* are very largely kept in check by the competition among the larvae in the presence of a dearth of food, other Dipterous competitors should be considered of importance in control, and if it could be proved that *L. sericata* is the original coloniser on living sheep, it might even be useful to protect other, competing species. The author believes, however, that the rate of reproduction of *L. sericata* is such as to make control by biological methods impracticable.

FRENEY (M. R.). **Sheep Blowfly Investigations. Experiments on Artificial Baits : Preliminary Note on the Products of Decomposition of Wool Fibre (Keratin).**—*J. Counc. Sci. Ind. Res.*, v, no. 1, pp. 28–30. Melbourne, February 1932.

During investigations in Australia on the responses of blow-flies to chemical substances it was found that an attractive medium resulted when wool fibre, obtained by extracting raw wool with ether and alcohol and washing with warm water, was decomposed by a solution of sodium sulphide. The fibre obtained as the final product may be considered as consisting largely of the protein keratin. A small quantity of decomposed keratin (less than 5 gm.), kept moist on cotton-wool, was used as a bait in experimental traps. Traps baited with 50 gm. fresh sheep's brain, which had been proved experimentally to be more attractive than liver, were exposed simultaneously. On the first day's exposure of the keratin mixture, large catches of blow-flies were recorded, and oviposition occurred on and around the bait. Numbers of small maggots were then present on the bait in most experiments. After the first day, smaller catches were successively recorded. Of 982 flies caught in 48 hours in a trap containing sheep's brain, 84 per cent. were females and 45 per cent. were primary blow-flies, as compared with 99·5 per cent. females and 81 per cent. primary blow-flies among 289 flies caught in a trap containing keratin placed a few feet away. It is pointed out that no useful quantitative comparison can be made between the catches, but the proportions of females and primary flies are significant. In other experiments keratin retained some degree of attractiveness for 6–7 days.

FRENEY (M. R.). **The Chemical Treatment of Baits for attracting Blowflies. I.**—*J. Counc. Sci. Ind. Res.*, v, no. 2, pp. 94–97, 1 chart, 1 ref. Melbourne, May 1932.

Following tests with keratin [see preceding paper], experiments were made on the effect of treating with sodium sulphide other substances rich in protein that are used as baits for blow-flies. In traps baited with 50 gm. fresh sheep's liver to which was added 20 c.c. either of water or of a 20 per cent. solution of hydrated crystalline sodium sulphide, the treated bait remained attractive much longer and was more attractive to all species of blow-flies trapped, though the increased attractiveness was somewhat greater for secondary than primary flies. Further tests were made with two traps, each containing 3 litres of a liquid bait prepared by allowing trapped blow-flies to decompose in water for five days, 50 gm. sodium sulphide being added to one of the baits, and the traps exposed from 29th February to 24th March. The period of attractiveness of the treated bait was much longer than that of the untreated one, the former catching 15,000 flies and the latter 300 between the 4th and 24th days of the experiment. The total effectiveness of the treated bait was 19 times that of the untreated one, and it was as attractive to primary blow-flies, and more than twice as attractive as fresh sheep's liver during the first eight-day period to secondary ones.

CUTHBERTSON (A.). **Notes on the Habits of some Diptera in Rhodesia.**—*Proc. Rhodesia Sci. Ass.*, xxxi, pp. 31–36. Bulawayo, 1932.

Brief notes are given on the bionomics of a number of flies occurring in Rhodesia, including certain species of *Stomoxys*, *Haematobia* (*Lyperosia*) *minuta*, Bezzi, and various blow-flies.

RUSSO (G.). **Informe de entomologia agricola dominicana.** [Report on agricultural entomology in San Domingo.]—*Inf. Estac. nac. agron. Col. Agric. Moca*, ii, pp. 33–244, 30 pls., 2 maps. [San Domingo] ? 1927. [Recd. July 1932.]

Part of this report on economic entomology in San Domingo in 1927 deals briefly with Arthropods attacking man and animals. The chief pests of cattle are *Hypoderma lineatum*, Vill., the screw worm fly, *Cochliomyia macellaria*, F., and the cattle tick, *Boophilus annulatus*, Say. *Sarcoptes caballi*, Oud. (*equi*, Gerl.), *S. canis*, Gerl., *S. suis*, Gerl., *S. ovis*, Mégn., and *S. caprae*, Fürst., occur on animals, and *S. scabiei*, L., on man. *Anopheles albimanus*, Wied., is the most important Anopheline and the vector of malaria. *Aëdes argenteus*, Poir., *Culex pipiens*, L., and *C. fatigans*, Wied. (*quinquefasciatus*, Say) are very common. Notes are given on the measures taken against these pests and against *Musca domestica*, L., and *Pulex irritans*, L.

Buchmann (W.). **Die Bekämpfung der Chironomidenbrut in Hallen- und Sommerbädern, sowie Wasserversorgungsanlagen mit Chlor und Kupfer.** [The Control with Chlorine and Copper of Chironomid Larvae in enclosed and open-air Swimming-baths, as well as in Water-supply Plants.]—*Z. GesundhTechn. u. Städtehyg.*, xxiv, no. 6, pp. 235–242, 5 refs. Dresden, June 1932.

The inconvenience caused in swimming-baths in Germany by the occurrence in the water of Chironomid larvae and their larval and pupal cases is discussed. The infestation of enclosed baths and tanks in the water-supply plants is due to the penetration of gravid females into the buildings through open windows, cracks in the roof, rents in the wire gauze in ventilation pipes, etc. Investigations on the control of the larvae [*R.A.E.*, B, xx, 111] were continued by testing the effect of chlorine and copper sulphate on the mature individuals. Tables are given showing the concentrations of the solutions and the results of their application. The larvae were not affected by the solutions of copper sulphate used, but all were killed in 190 minutes by a solution of sodium hypochlorite at a concentration of 5 cc. to 100 cc., equivalent to 12·95 mg. chlorine per litre of water. A solution of half this strength killed 80 per cent. of the larvae in 24 hours, whereas solutions containing 2·6 mg. and 1·3 mg. chlorine per litre had no effect within this period. All larvae were killed in 2 hours when a solution of copper sulphate at a concentration of 2·5 cc. to 100 cc. water (equivalent to 25 mg. copper per litre) was added to the 20 per cent. solution of sodium hypochlorite, and 80 per cent. were killed in 20 hours when 1·2 cc. copper sulphate was used in the solution at half this strength.

From these experiments the author concludes that an infested tank in a water-supply plant may be cleared of Chironomid larvae in 6–10 hours by the application of chlorine at a concentration of 12 mg. per litre, provided that the chlorine-binding property of the water, which depends on the content of organic and inorganic matter, is not too high. As the water in the swimming-baths is not often renewed, especially in open-air baths, which are not drained for weeks, 8 mg. chlorine per litre should be sufficient to obtain a satisfactory kill of the larvae in a day or two. The addition of copper sulphate would accelerate the action, and the effectiveness of the treatment could be increased by repeating it occasionally.

Peus (F.). **Die Stechmückenplage im Spreewald und die Möglichkeiten ihrer Bekämpfung.** [The Mosquito Plague in the Spreewald District and the Possibilities of its Control.]—*Z. GesundhTechn. u. Städtehyg.*, xxiv, nos. 3–4 & 5, pp. 133–142, 182–202, 6 figs., 1 diag., 7 refs. Dresden, March-April and May 1932.

In view of the fact that in the Spreewald district mosquitos cause serious annoyance in summer to tourists who constitute a very important source of income to the local population, detailed investigations were carried out during 1928–31 with a view to finding adequate measures for their control. Twenty of the 38 species recorded in Germany were found to occur there. A list of these is given, with notes in each case on the character of the habitat and the degree of importance. Of the species that attack man, *Aëdes communis*, DeG., and *A. geniculatus*, Ol., are confined to mixed deciduous forests, *A. punctor*, Kby., *A. maculatus*, Mg., *A. cinereus*, Mg., *Theobaldia alaskaensis*, Ludl., *A. annulipes*, Mg., *A. excrucians*, Walk., and *A. intrudens*, Dyar, are common in alder forests in marshy districts, *A. geniculatus*, Ol. (*lateralis*, Mg.) and *A. vexans*, Mg., occur in numbers in willow and alder plantations on meadow land, *Mansonia* (*Taeniorhynchus*) *richiardii*, Fic., *A. caspius*, Pall., *A. lutescens*, F., and *Anopheles maculipennis*, Mg., are abundant in open marshy meadow land, breeding in drainage ditches and stagnant water covered with dense vegetation, and *Theobaldia annulata*, Schr., and *Culex pipiens*, L., are common in and near human dwellings, thriving in ditches and accumulations of water polluted with organic matter.

A. intrudens, *M. richiardii* and probably *A. annulipes* have one generation a year. *Anopheles*, *Culex* and *Theobaldia*, which hibernate as adults, produce several generations, depending on the temperature conditions, whereas species of the genus *Aëdes* that hibernate in the egg stage and oviposit on the soil in places that are subsequently flooded usually produce two generations, corresponding to two peaks in the rise of the water in spring and late summer. Observations have shown that the abundance of these mosquitos in individual years is in direct proportion to the extent of the flooded area.

On the basis of these investigations, the author suggests the construction of a system of dams and weirs on the Upper Spree above the point where the river divides into numerous branches, by means of which the recession of the spring flood water may be delayed to compel the mosquitos to oviposit on soil at a higher level, and the summer flooding regulated to prevent the water from rising above the spring level, thus preventing the eggs that had been deposited in spring from hatching.

Another method, which consists in flooding the infested meadows in mid-October in order to cause the overwintering eggs to hatch and then killing the larvae by draining the meadow, has already been noticed [*R.A.E.*, B, vi, 212].

The species occurring in and near human dwellings may be controlled by regular spraying of the breeding places at intervals of 3–4 weeks from the beginning of May till the end of October, and by destroying the hibernating adults in their winter quarters.

ROUBAUD (E.) & COLAS-BELCOUR (J.). **Adaptation à la vie submergée hivernale chez les larves d'***Anopheles plumbeus*.—*C. R. Acad. Sci. Fr.*, cxciv, no. 24, pp. 2178–2180, 1 ref. Paris, 1932.

In view of the fact that the larvae of *Anopheles plumbeus*, Steph., instead of remaining at the surface of water, as do most mosquito larvae, generally live in the depths, at least during winter, the authors carried out experiments to determine the adaptability of the hibernating larvae to freezing and thawing. Larvae of *A. plumbeus* and of *A. maculipennis*, Mg., were placed in Borrel tubes in water with a film of paraffin and the tubes put into a refrigerator. The former were all living after 5 days, while the latter all died in 24–48 hours. Further experiments demonstrated more completely the length of resistance to winter submersion and to freezing of larvae of *A. plumbeus* in water that was not renewed. One larva resisted complete freezing of the liquid column, and another was alive after 61 days submersion in the cold and seven sudden successive thaws corresponding to the different times of examination. When replaced in normal conditions, after more than 2 months of submerged latent life, it carried on its development. These experiments show the characteristic adaptation of the larvae to hibernation in water submitted to successive freezing and thawing. Their position deep in the water is not accidental, but corresponds to the special conditions of reduced respiration. This adaptation signally complicates any methods of destruction by surface larvicides of the winter larvae of this species.

HACKETT (L. W.) & MISSIROLI (A.). **Housing as a Factor in Malaria Control.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxvi, no. 1, pp. 65–72, 9 refs. London, 30th June 1932.

In many malarious localities certain houses appear to have more than the average number of cases of malaria year after year, and the existence of such " malaria houses " has led to the hypothesis that they are especially attractive to Anophelines on account of their dark, ill-ventilated rooms, without ceilings and with cobwebbed corners, and their dampness and equable temperature. All houses fulfilling these conditions, however, are not " malaria houses," and in the authors' experience mosquitos often frequent houses that do not appear to be favourable to them. It has been assumed that if certain physical conditions lead Anophelines to remain in houses or to return to them repeatedly, then the absence of such conditions will tend to keep them out. From this is derived a programme of malaria prevention based on the improvement of housing and standards of living, which relegates to second place or even disregards any effort to suppress Anopheline breeding. The authors discuss their own observations and experiments, which do not support the premisses on which this theory rests.

Observations in a non-malarious region in Italy showed that many Anophelines enter recently constructed, well-lighted houses if they contain cows but that few do so if they contain human beings. In the same region, in a village where the people still inhabit massive farmhouses, badly lighted and ill-ventilated, not a single individual of *Anopheles maculipennis*, Mg., has been caught containing human blood. In a highly malarious region where housing conditions are strictly comparable, Anophelines not only enter the dark, damp, badly screened houses, but manage to find their way into the bedrooms of newly-constructed, well-screened houses in spite of the fact that unscreened stables occupied by cows and horses are built under the same roof as the living quarters. In an agricultural area in the north of Germany where the conditions of living are comparatively high, malaria is still endemic, whereas in a similar but less prosperous area in the south, malaria has disappeared, in spite of an apparently equal prevalence of Anophelines.

A. maculipennis is a domestic mosquito, which generally passes the day indoors but is surprisingly active after sunset. More than three-quarters of the mosquitos in a stable have been observed to leave at dusk, their places being taken by new comers. The interchange recurs at dawn, and this happens with little regard to the stage of digestion. There is no good evidence to show that the disposition of a mosquito to remain in the place where it has fed is an important factor in its becoming infective and transmitting malaria. Some effective vectors, such as *A. maculipennis* and *A. quadrimaculatus*, Say, remain in the house after biting for a day or more, whereas others equally or more dangerous, such as *A. maculatus*, Theo., and *A. minimus*, Theo., normally leave the house after biting and are not found during the day. Thus the construction of the house, etc., is obviously of less importance than its situation with regard to breeding-places and the ease with which mosquitos can obtain ingress to the bedrooms. No evidence has been obtained in staining experiments that mosquitos return repeatedly to a place offering abundant nourishment and satisfactory shelter.

It would seem, therefore, that *A. maculipennis* enters buildings to feed, but that in some regions it shows great persistence in trying to enter human habitations whereas in others it practically confines its activities to the stables. This difference in behaviour is apparently due not to the character of the building but to variations within the species in different regions [*R.A.E.*, B, xx, 57]. There are two distinct races, *A. maculipennis* var. *labranchiae*, Fall., and *A. maculipennis* var. *messeae*, Fall., in Europe, and the most important difference between them, from the point of view of the epidemiology of malaria, lies in their food preferences. The former bites both man and animals wherever it has been found and is associated with man, the effect of the proximity of stabled animals not being sufficient to prevent malaria. The latter, in certain regions, bites only animals and is completely dissociated from man. Whether in other regions with fewer or unstabled domestic animals this race is still an effective malaria vector is not yet known, but its diversion by stabled animals is apparently relatively rapid and complete. The phenomenon of "anophelism without malaria" would seem therefore to be associated with the food preferences of a certain race of *A. maculipennis* rather than with housing standards. There does not appear to be any satisfactory evidence of the permanent disappearance of malaria with the persistence in great numbers of the Anopheline vector in connection with any species other than *A. maculipennis*. Anti-malaria measures should be directed chiefly to screening houses and eliminating breeding-places. In time, the development of a more intensive agriculture and the consequent stimulation to animal husbandry and the stabling of domestic animals may, at least in areas where *A. maculipennis* is prevalent, reduce anti-larval measures by favouring the progressive ascendancy of an innocuous race of mosquitos.

KLIGLER (I. J.). **The Movements of *Anopheles* at Various Seasons of the Year with special Reference to infected Mosquitoes.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxvi, no. 1, pp. 73–88, 2 graphs, 24 refs. London, 30th June, 1932.

During the last three years, systematic studies have been made in Palestine on the range of flight and distribution of Anophelines and their relative distribution in houses and stables at different seasons of the year. Apart from the fact that different species may have different ranges of flight, it is now clear that the distance covered is regulated by environmental conditions. During the active breeding period in spring and early summer, flight is made for the purpose of feeding, and the necessity for oviposition leads the mosquito back to the breeding area, only stray individuals travelling far. In the prehibernating period in autumn, when there is no urge to deposit eggs, the mosquitos seek shelter and large numbers migrate far beyond the spring and summer limit [*cf. R.A.E.*, B, xiii, 40; xvi, 182; xix, 123].

A study of the seasonal distribution of *Anopheles sacharovi*, Favr (*elutus*, Edw.) in a village near the breeding area during 1930 showed a maximum prevalence in houses in May and June and a still greater prevalence in stables during November and December, so that zoophilism obviously plays no part, and the preference for hut or stable appears to be entirely a seasonal phenomenon, regulated presumably by temperature, humidity and food-supply.

To obtain data on the length of time that Anophelines remain in buildings an extensive series of experiments was undertaken in huts that could be taken to pieces and put up again. By this means it was found that the number of mosquitos entering a hut during one night was about half the total number that accumulated during a week. Moreover, the total of " old " mosquitos with partially developed ovaries that came in during one night was 30–45 per cent. of the number found after a week. The results indicate that *A. sacharovi* constantly changes its abode even before its eggs are mature. Precipitin tests of the blood in mosquitos taken in houses and stables also show that change of resting place occurs even immediately after a feed [*cf.* xvii, 250]. Further blood tests were made in two different types of village to ascertain why in these experiments Anophelines with animal blood were found in houses whereas those containing human blood were not found in stables. In a village built with stables in the same courtyards as the houses much the same results were again obtained. In May, 54 per cent. of the mosquitos taken in houses contained human blood, but in June and July the incidence of cattle-fed mosquitos increased. This was due to the fact that during the summer the cattle spend the night in the courtyard and not in the stables. In the other village, which is composed of huts, many of the people as well as the animals sleep out of doors in summer. Hence Anophelines containing human blood are more common in stables.

Mosquitos infected with oöcysts and sporozoites were found in stables as well as houses at all times of the year, although their incidence in houses was greater than in stables, particularly during their active period. It cannot therefore be maintained that infected mosquitos have a definite " housing " instinct and return to the same spot after oviposition ; their concentration is apparently regulated by the same factors as that of normal mosquitos, *i.e.*, food reservoir and shelter. Of 84 mosquitos caught in the experimental huts the morning after they had been reassembled, one contained large cysts, thus demonstrating a change of abode during the development of infection. Epidemics of malaria in Jewish villages with no gametocyte-carriers can only be explained by dispersion of infected mosquitos from adjacent infected Arab villages, within a radius of about 1,000 yards. On the other hand, when the inhabitants of one of two malarious villages about 1¼ miles apart were treated with plasmochin the percentages of gametocyte-carriers and infected mosquitos were 5·5 and 0·6, as compared with 24 and 2·5 respectively in the untreated village. Thus it may be tentatively concluded that during the active spring and summer breeding period, infected mosquitos are not likely to travel 1¼ miles when there is no habitation between the two settlements and the breeding area is close to the village.

The long range dispersion of infected mosquitos in autumn is no longer open to doubt, as there is no other way of accounting for the equally high incidence of infected mosquitos in two villages, one highly infected and the other practically free from malaria during the greater part of the year. This fact was confirmed by treating the inhabitants of two villages near the Huleh marsh suspected of being the source of infected mosquitos in a hill village [xix, 123]. The decrease in the incidence of gametocyte-carriers was associated with an unusually low incidence of infected mosquitos in all three villages and a decided reduction in the number of new infections in Rosh Pinah.

Alessandrini (M.). **Relazione su alcuni casi di malaria primitiva autoctona nel comune di Ancona.** [Report on some Cases of primary locally acquired Malaria in the Town of Ancona.]—*Riv. Malariol.*, xi, no. 1, pp. 30–34. Rome, 1932. (With Summaries in Italian, p. 130, French, p. 132, English, p. 133, German, p. 135.)

Though there were 12 cases, 8 in 1930 and 4 in 1931, of locally acquired malaria in Ancona, no Anophelines have been found, and as all the cases occurred in close connection with the railway, the infection is attributed to mosquitos in trains passing through the town. A similar observation has been recorded at Kuala Lumpur [*R.A.E.*, B, xix, 4].

Rameritza (E.). **Malaria in Roumania.**—*Riv. Malariol.*, xi, no. 1, pp. 42–51, 6 refs. Rome, 1932. (With Summaries in Italian, p. 130, French, p. 132, English, p. 134, German, p. 135.)

An account is given of the history of malaria in Rumania, where it is a serious problem. *Plasmodium vivax* is the most common malaria parasite and is present in nearly 62 per cent. of the cases. *P. falciparum* occurs throughout the country, but the quartan form [*P. malariae*] is rare. General antimalarial work was begun in 1923, and in 1926 a study of the mosquito fauna was undertaken by G. Zotta, in the Danube delta. The species found include *Anopheles maculipennis*, Mg., *A. hyrcanus* var. *pseudopictus*, Grassi, and *A. sacharovi*, Favr (*elutus*, Edw.).

de Buck (A.), Schoute (E.) & Swellengrebel (N. H.). **Further Investigations on the racial Differentiation of** *Anopheles maculipennis* **in the Netherlands and its bearing on Malaria.**—*Riv. Malariol.*, xi, no. 2, pp. 137–156, 1 pl. Rome, 1932. (With Summaries in Italian, p. 265, French, p. 267, English, p. 269, German, p. 271.)

In further investigations on the differentiation of *Anopheles maculipennis*, Mg., in Holland into a shortwinged multidentate race (var. *atroparvus*, van Thiel), dangerous as regards malaria, and a harmless longwinged paucidentate one, the value has been confirmed of the morphological characters already found [*R.A.E.*, B, xv, 181; xviii, 228]. A further one is the appearance of the tissue between the ribs of the egg-floats. In the shortwinged race it is smooth, whereas in the longwinged there is a network of minute crossbars. This applies to mature eggs before and after oviposition. The crossbars differ from the wrinkles, which are due to shrinkage, in the films of eggs laid in water of high salinity. In crossings of the two races the structure of the egg-shell conforms to that associated with the female parent. Longwinged individuals do not mate in confinement, though some may be induced to do so with the shortwinged variety. During hibernation (August-March), human blood in the stomach of a longwinged mosquito kept at 22°–24°C. [71·6°–75·2°F.] becomes separated as soon as ingested into a clear semitransparent plasma and a red, opaque portion containing the corpuscular elements, this condition persisting for 24 hours, whereas in the shortwinged variety the plasma is rapidly reabsorbed and the stomach becomes entirely filled with the red corpuscular mass within half an hour of feeding. The longwinged race does not show the decided preference for fresh water for oviposition exhibited by the shortwinged one. Larvae of the latter, however, are better able to tolerate a sudden rise in the salinity of the breeding-place. If the salt content of water in which oviposition has occurred is as much as 1 per cent., a higher percentage of eggs of the short-winged variety hatch than of the longwinged.

De Muro (P.). **Sulla presenza dell'*Anopheles plumbeus* nelle Paludi Pontine.** [On the Presence of *A. plumbeus* in the Pontine Marshes.] —*Riv. Malariol.*, xi, no. 2, pp. 191–196, 2 figs., 36 refs. Rome, 1932. (With Summaries in Italian, p. 266, French, p. 268, English, p. 270, German, p. 272.)

Anopheles plumbeus, Steph., is recorded as occurring in woods near Terracina, Pontine Marshes [*cf. R.A.E.*, B, xviii, 111].

Villain (G.). **Note sur la présence de larves d'anophélines dans les eaux salées du Sahel Tunisien.**—*Riv. Malariol.*, xi, no. 3, pp. 346–352, 12 refs. Rome, 1932. (With Summaries in Italian, p. 410, French, p. 412, English, p. 414, German, p. 416.)

Anopheles maculipennis, Mg., and *A. multicolor*, Camb., have been observed in Tunisia breeding in water with a pH of 8·4 and a content of chlorides of 35·4 per mille, which shows that *A. maculipennis* can occasionally adapt itself to water free from vegetation and with a salt-content higher than that of sea-water.

Covell (G.). **Malaria in Calcutta.**—*Rec. Malaria Surv. India*, iii, no. 1, pp. 1–55, 4 pp. refs., 5 figs., 3 maps, 1 chart, 1 graph. Calcutta, June 1932.

An account is given of an investigation, carried out between 26th January and 25th February 1932, of the malarial conditions in Calcutta, where the amount of endemic malaria is very slight at the present time. Transmission of the disease probably occurred in the city from the earliest times, and there is definite evidence that there has been a considerable amount of locally acquired infection at various times during the past 30 years. *Anopheles stephensi*, List., is undoubtedly the vector in Central Calcutta and breeds freely throughout the city, chiefly in cisterns and other receptacles for storing water [*R.A.E.*, B, xx, 30]. The institution of a vigorous campaign against its breeding-places, such as that recommended in the case of Bombay [xviii, 73], is suggested as the obvious remedy. As these breeding-places are also those favoured by *Aëdes argenteus*, Poir. (*aegypti*, auct.), which is very troublesome in Calcutta, such a campaign will also be effective against this mosquito.

Much of the information on the breeding-places of *A. ludlowi* var. *sundaica*, Rdnw., another well-known carrier of malaria that has been found at various points within 12–20 miles of Calcutta, has already been noticed [xx, 29]. It is recommended that the project now under consideration for introducing silt-laden water from the Hooghly into breeding-places of this mosquito should be put into immediate effect and that control measures should be rigidly enforced in the remaining breeding areas. There is a danger of its gaining a footing in the Salt Lake area to the east of the city. The Salt Lakes were formerly tidal, and thus unsuitable as breeding grounds for this mosquito, and measures should be taken to restore tidal influence in them.

Covell (G.). **Malaria in Patiala State.**—*Rec. Malaria Surv. India,* iii, no. 1, pp. 83–101, 2 maps. Calcutta, June 1932.

Records are given of a malarial survey carried out in 1931 in certain towns and villages of Patiala State, where the disease is most severe in the Himalayan foothills and in the Ghaggar tract. *Anopheles culicifacies,* Giles, which breeds intensively in stagnant waters, is considered to be the principal carrier of malaria in the plains and cities, and *A. listoni,* List., in the hills. *A. subpictus,* Grassi, and *A. fuliginosus,* Giles, also occur in large numbers, but are not likely to be concerned in the transmission of malaria.

Recommendations made for the control of malaria in Patiala city and the villages surrounding it, and in Pinjaur, include the prohibition of wet cultivation and the treatment with Paris Green of seepage outcrops and streams in the vicinity of the city or villages, the re-lining of certain irrigation channels, the oiling of sundry wells, which should also be provided with cement-concrete covers, and the reservation of certain tanks for drinking purposes and the stocking of them with *Gambusia,* the remaining tanks being treated with Paris green if they are found to harbour malaria-carrying mosquitos.

Covell (G.) & Baily (J. D.). **Malaria in Sind. Part VIII. Malaria in Shahbandar Division, Karachi District, Sind.**—*Rec. Malaria Surv. India,* iii, no. 1, pp. 103–124, 1 map. Calcutta, June 1932.

A malaria survey was made of the Shahbandar Division of Sind from 12th to 26th September 1931, investigations being carried out in 55 villages. This area, which is outside that embraced by the Sukkur Barrage Scheme [*R.A.E.*, B, xix, 43], is, as a whole, highly malarious. *Anopheles culicifacies,* Giles, which is the vector of the disease, breeds chiefly in the beds of canals and the channels from them when the water is subsiding in them towards the end of the inundation season, in collections of water drained from rice-fields, and in water leaking from canals, etc., into borrow-pits. The amount of malaria in any locality is directly proportional to the number and proximity of such breeding-places. On the other hand its incidence in villages situated on the banks of large lakes or on embankments built across them is comparatively slight. The chief anti-malaria measures recommended are the prohibition of wet cultivation in the vicinity of towns, the treatment of the margins of canals and their distributing channels with Paris green and the filling in of borrow-pits.

Strickland (C.) & Murphy (R. A.). **River-sand silting and other Antimalarial Measures in South Sylhet, Assam.**—*Rec. Malaria Surv. India,* iii, no. 1, pp. 125–142, 5 pls., 3 maps, 2 diag. Calcutta, June 1932.

An account is given of malaria control measures undertaken with satisfactory results in three tea gardens in South Sylhet, Assam, where *Anopheles minimus,* Theo. (*funestus,* auct.), *A. aconitus,* Dön., *A. culicifacies,* Giles, and *A. philippinensis*, Ludl., all reputed vectors of malaria, were found to be present. The measures consisted chiefly of drainage and the subsequent covering of the drains with natural jungle growth or artificial plantings, using chiefly wild rhododendron (*Melostoma* spp.), clearing and training of streams, and, on one estate, the utilisation of the silt carried by the streams to silt up the foothill marshes, thus converting them into meadows suitable for grazing [*cf. R.A.E.*, B, xix, 76].

Manson (D.) & Ramsay (G. C.). **Some Findings in a Malaria Survey carried out on a Group of Tea Estates in the Sibsagar District of Assam from August 1, 1930 to July 31, 1931.**—*Rec. Malaria Surv. India*, iii, no. 1, pp. 143–160, 1 map, 2 graphs, 3 refs. Calcutta, June 1932.

The results obtained in this survey of tea gardens in the Jorhat district of Assam largely confirm the findings noticed in a preliminary report [*R.A.E.*, B, xix, 226]. The 16 species of Anophelines found have been recorded in a previous paper [xviii, 30]. *Anopheles minimus*, Theo., was again the only species found infected with malarial parasites, the rate being 4·67 per cent. The highest infection rate in mosquitos was found in October and November, and much transmission takes place during this period, though a decrease in malarial sickness occurs during the cold months. This is probably due to the great diminution in numbers of *A. minimus* frequenting dwellings, to a decrease in their feeding activity owing to low night temperatures and to the fact that the infection, at any rate in partly immune persons, is latent during the cold weather and becomes manifest when the physical resistance is lowered by climatic conditions during the hot weather.

Perennial rivers and streams are endemic breeding grounds of *A. minimus* during the cold weather until the onset of the monsoon, when they become laden with silt [*cf. R.A.E.*, B, xix, 76]. Rice-fields lying fallow in close proximity to dwellings are potential breeding-places until they are cultivated. Drinking-water reservoirs on a terrain where the water remains clear during the malaria transmission season and drains carrying clear water are also a source of infestation. Silt as an anti-malarial factor acts almost entirely through its action on the larvae and not indirectly by increasing the yield of crops. Some bridges and culverts that decrease the natural flow of water create ideal breeding-places. Temperature directly affects the feeding stimulus of *A. minimus*, for during the cold weather months engorged adults were found chiefly in bungalows and hospitals that were heated by fires. Unfed individuals were usually collected from unheated dwellings.

Bose (K.). **Confirmation of *A. philippinensis* as a Malaria Carrier in Bengal.**—*Rec. Malaria Surv. India*, iii, no. 1, pp. 161–162, 2 refs. Calcutta, June 1932.

Further dissections of *Anopheles philippinensis*, Ludl., by two different workers, undertaken during September–November at Birnagar, revealed a malaria infection rate of 1·4–2·5, thus confirming Sur's finding of natural infection in this mosquito [*R.A.E.*, B, xvi, 248; xix, 204]. It was found to be more prevalent in dwellings at night than during the day.

Mulligan (H. W.) & Majid (Abdul). **Some experiments to determine the Efficacy of Wire Gauze Screens of different Apertures in excluding Anopheline Mosquitoes in India.**—*Rec. Malaria Surv. India*, iii, no. 1, pp. 163–169, 1 fig., 4 refs. Calcutta, June 1932.

In considering the use of screening as an anti-malarial measure, it is important to utilise a type of wire-gauze that will allow of the maximum amount of light and ventilation and at the same time afford adequate protection against the malaria-carrying mosquitos of the locality. The number of openings to the linear inch is an inadequate measurement, as the size of the aperture varies within wide limits according to the thickness of the wire. Experiments to determine the optimum aperture were therefore undertaken, using rectangular skeleton boxes constructed in such a way that five sides could be fitted with interchangeable gauze panels. Sets of panels were prepared from seven different types of wire gauze, ranging from 11 to 20 openings to the linear inch. The actual size of the aperture in each sample was determined by calculating the proportion of one linear inch of gauze not occupied by wire and dividing the result by the number of openings. *Anopheles culicifacies*, Giles, one of the smallest and also one of the most dangerous malaria carriers in India, was utilised in most of the experiments.

A known number of mosquitos was introduced into the gauze box through a hole in the cardboard lid, which was subsequently plugged with cotton wool. By means of hooks at the four top corners the box was then suspended in a large breeding cage in which a basin of water and some raisins had been placed to induce the mosquitos to escape through the gauze. The numbers of mosquitos that had escaped were counted at intervals of 24, 48 and 72 hours. At the end of the experiment the number of mosquitos remaining in the gauze box was counted. Several experiments were carried out with each type of gauze.

It would appear from the results that an aperture 0·055 in. square affords adequate protection against *A. culicifacies.* An aperture between 0·045 and 0·050 in. square would be necessary to exclude this mosquito entirely, but it is not considered that the loss of light and air incidental to the use of such a fine mesh would justify its employment. Although *A. listoni*, List., is a very small and pertinacious mosquito, not a single individual escaped in 24 hours in an experiment using an aperture of 0·055 in. square, and similar results were obtained with *Culex fatigans*, Wied.

Soesilo (R.) & van der Hout (O. H.). **Het verband tusschen melasse-liquidatie in irrigatie-leidingen en malaria ; de ecologie van** *Anopheles aconitus.* [The Connection between Malaria and the Disposal of Molasses in Irrigation Channels ; the Ecology of *A. aconitus.*]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 13, pp. 842–850, 10 refs. Batavia, 21st June 1932.

In 1931 an investigation was made in Java to ascertain at what dilution the residual molasses from sugar-cane factories could be present in irrigation channels, etc., without danger as regards malaria, there being some doubt as to the effect on *Anopheles aconitus*, Dön., of the large quantities of organic matter involved. Very few Anopheline larvae were observed in these waters, which were found to contain 1 per mille of molasses, and none of *A. aconitus*, a species that commonly occurs in waters with a low content of organic material.

Corbett (G. H.) & Hodgkin (E. P.). **Laboratory Experiments on the Larvicidal Properties of Mineral Oils.**—*Bull. Inst. Med. Res. F.M.S.*, no. 5 of 1931, 20 pp., 17 figs., 3 refs. Kuala Lumpur, 1931.

An account is given of preliminary laboratory experiments undertaken with a view to the ultimate preparation of a standard specification for oils in mixtures used as mosquito larvicides that will be applicable throughout Malaya, whereby the less effective of the heavy oils may be eliminated and a reduction effected in the relative quantity of the more costly components, namely, solar and light oils. The results were estimated by calculating the percentage of larvae found dead on successive examinations at short intervals. The effect of temperature and humidity was eliminated by carrying out comparable experiments simultaneously. Physical factors, such as the preparation of oil films, were standardised as far as possible, and freshly caught fourth stage larvae of *Anopheles vagus*, Dön., were used except in a very few cases. Large batches of larvae were employed in order that biological variation should not affect the tests. The technique of the experiments is described, and the results are given in both tabular and graphical forms. Most of the films were made 18μ thick though occasionally they were 10·8μ. The samples of oil comprised 2 heavy oils, 1 solar oil and 6 light oils, the specifications for all of which are given.

In tests with each oil separately, using both thicknesses of fresh film, the light oils (with one exception) were found to kill most rapidly, the heavy oils being slowest in action. One heavy oil was markedly slower in action than the other, probably owing to its high viscosity. The solar oil killed fairly rapidly in all experiments and proved to be the most toxic to pupae. Mixtures of the three most promising light oils with constant proportions of solar and heavy oils showed that the most satisfactory was a light oil with the following specifications: specific gravity at 15°C. of 0·94, Engler viscosity at 30°C. of 1·20, flash point 100°C., A.S.T.M. distillation of 40 up to 250°C. and 90 up to 300°C., average volatility of 260°C., and aromatic content of 60 per cent. by weight. This oil and the less viscous heavy oil were therefore used in all subsequent experiments requiring a light or heavy oil. Little difference was found between mixtures containing varying proportions of the heavy oil and solar oil, though proportions of 3 and 2 parts solar to 1 part heavy killed rather more rapidly than the others. The rate of kill in mixtures containing the heavy and light oils increased with the proportion of light oil, but only to a marked degree where the proportion was high. A mixture of equal parts of the heavy and light oils proved more rapidly toxic than light oil alone. When solar and light oils were used together, the rapidity of kill decreased regularly with the decrease in the proportion of light oil. When all three oils were used, the proportion of light oil was maintained at 1 in 12 and the proportion of the other oils was varied. A fairly regular decrease in immediate toxicity was noted as the proportion of heavy oil increased. With proportions of 3 parts heavy, 9 solar and 1 light, or 6, 6 and 1, all larvae succumbed in the first two hours. As a result of the foregoing experiments four mixtures were selected with a view to obtaining suitable oils for field experiments, having due regard to cost. These consisted of 2 parts heavy to 1 solar, 12 heavy to 1 light, 3 heavy and 3 solar to 1 light, and 8 heavy and 4 solar to 1 light. These mixtures together with the heavy, solar and light oils separately were tested as films of different ages. Two films of each were prepared once a week for five weeks, and on the following six days ten fresh larvae were introduced daily. The results showed that heavy oil is undoubtedly the component responsible for persistence in the toxicity of a mixture, although a small quantity of solar also appears to be of some value. In the case of the first and last mixtures the proportion of solar to heavy oil is 1 to 2, but the addition of the light oil in the last mixture resulted in a greater number of deaths in a shorter period of time. Solar oil increases fluidity and appears to facilitate spreading. The fluidity of a mixture is undoubtedly of importance, as it facilitates penetration of the oil into the tracheae of the larvae.

Heavy oil spread better than solar but soon collected into blobs (though after 24 hours the film became more even and coherent) whereas during the first 24 hours solar remained even. Mixtures containing equal parts of these two oils produced and maintained even films, whereas those with 3 parts solar to 8 heavy at first formed good films but subsequently collected into blobs. Those with 2 parts heavy oil to 1 of solar behaved like heavy oil alone. The light oils, especially the more volatile ones, spread unevenly, and it would be inadvisable to employ too great a proportion of them in the mixtures. A few experiments were carried out to test the toxicity of oil vapours. The vapours of the most volatile oils seem generally to be the most rapidly toxic. The vapours, if any, from the heavy oils and solar oil were not toxic. Experiments using other species of mosquito larvae, showed that *Anopheles maculatus*, Theo., and *A. hyrcanus*, Pall., are markedly more resistant than *A. vagus*, whereas *Culex* spp. succumbed more rapidly. *Aëdes* (*Stegomyia*) spp. proved more resistant than Anophelines.

The manner in which oil kills Anopheline larvae is discussed [*cf.* *R.A.E.*, B, xv, 68]. Larvae break right through a film, the spiracles coming into contact with the air as though no oil were present, but during this process oil enters the tracheae. In laboratory experiments, and probably also under natural conditions, most larvae come to the surface repeatedly, so that even if an insufficient quantity of oil enters the first time, some will enter on subsequent occasions. For these reasons oil used as a thin film should penetrate the spiracles rapidly and should be toxic in small quantities. It should spray well, form a good film and retain for some days a moderate degree of toxicity. The properties believed to be of importance in determining the larvicidal efficiency of an oil are briefly discussed. The viscosity of an oil is inversely proportional to its powers of penetration. Surface tension, as measured against both air and water, determines its spread as a film on water. The best spreading oils produced the strongest films. Volatility is only of importance in considering such gross differences as those between heavy and light oils. Amongst the light oils volatility showed no relationship to toxicity, this having been masked by differences in aromatic content. In the case of pupae, probably owing to the form of the spiracular openings, viscosity and surface tension appear to play a less important rôle than with the larvae, light oils with high volatility (and low aromatic content) being slower in action than the non-volatile heavy oils. The power of an oil film to retain its toxicity for a considerable period appears to vary inversely with its volatility. The light oils evaporated and the film was rapidly rendered incomplete. The films of heavy oils evaporated slowly, and became more viscous and difficult for the larvae to penetrate, and consequently the rapidity of kill decreased with the age of the film.

Hinman (E. H.). **The Utilization of Water Colloids and Material in Solution by Aquatic Animals with especial Reference to Mosquito Larvae.**—*Quart. Rev. Biol.*, vii, no. 2, pp. 210–217, 41 refs. Baltimore, Md., June 1932.

The literature on the question of the utilisation of material in solution by aquatic animals is reviewed, with special reference to that dealing with mosquito larvae. After referring to his own experiments with Anopheline larvae [*R.A.E.*, B, xx, 173], the author states that unpublished data demonstrate that larvae of *Aëdes argenteus*, Poir. (*aegypti*, auct.), *Culex fatigans*, Wied. (*quinquefasciatus*, Say) and *C. salinarius*, Coq., also derive nutritive elements from the non-dialysable fraction of water from the pools in which they breed. Work in progress shows that mosquito larvae are able to subsist for a period, in certain cases exceeding 10 days, in various amino-acids and carbohydrates (C. P.) dissolved in Ringer's solution or physiological saline, in sterile conditions. While no recognisable growth was made, the fact that these larvae were able to remain alive and active for such long periods clearly indicates that they must derive nourishment from these substances.

Absorption through the skin is discussed. Many aquatic animals probably utilise organic material in true solution as well as water colloids, but this method should be regarded as supplementary to other feeding habits. Direct absorption of these materials by the cells of the intestine is believed to be of greater importance, at least in the case of mosquito larvae, than cutaneous absorption.

Schüffner (W.). **Entwicklung und heutiger Stand der Gelbfieberforschung.** [The Development and present Position of Yellow Fever Research.]—*Klin. Wschr.*, xi, no. 18, pp. 753–757, 7 figs. Berlin, 30th April 1932.

Work by various authors on yellow fever is briefly reviewed, and an account is given of the results of experiments by Dinger, Snyders, Swellengrebel and the author at Amsterdam dealing chiefly with the pathogenicity of the virus to man and animals. In the course of this work it was found that its virulence, at a time when direct inoculation into *Macacus rhesus* was no longer successful, re-acquired its full strength when passed through the mosquito, *Aëdes argenteus*, Poir. (*aegypti*, auct.).

Strong (R. P.), Bequaert (J. C.) & Cleveland (L. R.). **Report on the available Evidence showing the Relation of Game to the Spread of Tsetse-fly borne Diseases in Africa.**—*Spec. Pub. Amer. Comm. Intern. Wild Life Prot.*, i, no. 1, 46 pp., refs. Cambridge, Mass. 1931.

The literature on the part played by game in the relation to trypanosomes pathogenic to man and domestic animals in Africa is reviewed and discussed in detail. The evidence that there are two distinct species of trypanosome, *Trypanosoma gambiense* and *T. rhodesiense*, that give rise to sleeping sickness in man is not conclusive and there is, moreover, considerable evidence suggesting that they constitute slightly varying strains or races of a single species. The evidence that game animals act as reservoirs of sleeping sickness is not extensive, and much of the information suggests that they do not ; on the other hand, although there is a certain amount of negative evidence, there is also some positive evidence that they act as reservoirs for the trypanosomes causing diseases of domestic animals. No definite proof has been submitted to show that the abundance of game has a definite relation to the number of tsetse-flies present in a given district, but there are indications that the flies will sometimes migrate with game. The relation between the presence of game and the breeding-places of the fly varies somewhat with the species. In the case of *Glossina morsitans*, Westw., and other tsetse-flies of similar habits, there is some evidence that the breeding-places are generally close to areas where wild game is fairly abundant. With reference to diet and food preferences, there is little evidence that *G. palpalis*, R.-D., and *G. tachinoides*, Westw., depend on game, and it seems probable that neither could be eradicated by eliminating such animals, though there appears to be some evidence that *G. morsitans* will disappear when the numbers of large game are considerably reduced.

NAPIER-BAX (S.). **Notes on Anti-tsetse Clearings.**—*Mem. Dept. Tsetse Res. Tanganyika*, no. 1, 15 pp., 6 pls. Dar-es-Salaam, 1932.

In this paper, which is based on three years' intensive work on methods of clearing bush for the control of *Glossina* in Tanganyika Territory, the author discusses types of clearing, the manner in which the work should be carried out, the best methods and cost of killing various species of trees.

PONS (R.). **Essais de désinsectisation durable du sol sablonneux des cases au Sénégal.**—*Bull. Soc. Path. exot.*, xxv, no. 6, pp. 539–541. Paris, 1932.

The fleas that are found in extraordinary numbers in the sandy floors of the huts in villages in Senegal appear to belong almost entirely to the species *Synosternus pallidus*, Tasch. [*R.A.E.*, B, xix, 221]. The part that this flea plays in the transmission of plague has not been definitely ascertained, but 6 out of 12 guineapigs inoculated with a suspension of individuals taken in infected dwellings showed typical symptoms of the disease. Moreover, a village that is not situated on sandy soil is the only one that has never suffered from outbreaks of plague comparable to those that are periodically observed in the other villages, and no fleas of this genus were found in the floors there.

In view of the possible rôle of *S. pallidus* in the transmission of plague, it has been prescribed that the floors of plague-infected huts be sprayed with a strong solution of cresyl. All insects are immediately destroyed, but re-infestation from neighbouring dwellings takes place rapidly. Investigations were therefore undertaken to discover a cheap and more stable insecticide. A satisfactory material was obtained by mixing a road tar derived from petroleum with two-thirds of a light oil (a residue from the distillation of petroleum), both products of the Standard Oil Company. In this way the tar is rendered sufficiently fluid to penetrate the sand rapidly. To be really effective the material should penetrate to a depth of about 12 ins., which necessitates the application of a layer nearly 1 in. thick. The mixture is absorbed immediately and leaves no deposit to cause the sand to adhere to the shoes or feet, but a small quantity of dry sand may be sprinkled over the surface. The smell is not as disagreeable as that of cresyl and does not irritate the mucous membranes. In experiments in four huts, no insects were found in soil as much as 30 days after treatment with this material.

LEFROU (G.). **Considérations étiologiques sur l'épidémie de peste de 1929 à Saint-Louis du Sénégal.**—*Bull. Soc. Path. exot.*, xxv, no. 6, pp. 597–606, 7 refs. Paris, 1932.

The author gives an account of the outbreak of plague that occurred at Saint-Louis, Senegal, in 1929. As no epizootic occurred among rats before, during or after the epidemic, it is thought that transmission must have taken place from man to man by means of fleas, which were extraordinarily abundant [*cf.* *R.A.E.*, B, xviii, 250]. In view of Roubaud's determination of the fleas in the region of Tivouane as *Synosternus pallidus*, Tasch. [xix, 221], it is assumed that the fleas at Saint-Louis, previously believed to be *Xenopsylla cheopis*, Roths., probably also belong to this species.

FONQUERNIE (J.). **Les puces domestiques à Tananarive.**—*Bull. Soc. Path. exot.*, xxv, no. 6, pp. 542–543. Paris, 1932.

The author's observations confirm those of other workers [*R.A.E.*, B, xx, 148] as to the rarity of *Xenopsylla cheopis*, Roths., in dwellings in Tananarive and its environs, except on rats, on which it constitutes 10 to 50 per cent. of the flea population.

GASCHEN (H.). **Influence de la température et de la nutrition larvaire sur le développement de** *Culex pipiens* **(race autogène).**—*Bull. Soc. Path. exot.*, xxv, no. 6, pp. 577–581, 2 graphs. Paris, 1932.

Experiments in which individuals of the autogenous race of *Culex pipiens*, L. [*R.A.E.*, B, xix, 215, etc.] were reared on different foodstuffs and at different temperatures, showed that a larval diet rich in nutritive material affects both the size of the resulting adults and the number of eggs they lay (a protein food being more suitable than one lacking nitrogen), and that development is completed in 39 days at a temperature of 20–25°C. [68–77°F.], whereas 66 days are required under similar conditions of nourishment at a temperature of 14–15°C. [57·2–59°F.].

TOUMANOFF (C.). **Sur les gîtes larvaires types des Anophèles au Tonkin.**—*Bull. Soc. Path. exot.*, xxv, no. 6, pp. 639–656, 4 pls., 4 graphs, 14 refs. Paris, 1932.

A detailed account is given of investigations on the breeding-places of 14 species of Anophelines in Tonkin and part of North Laos, undertaken with a view to determining whether the individual species show marked preferences for particular sites. Ten types of breeding-places are defined and the distribution of each species in them is discussed. It is concluded that whereas most of these Anophelines show no marked selection, *Anopheles minimus*, Theo., and *A. maculatus*, Theo., the principal vectors of malaria in Tonkin, display distinct preferences. *A. maculatus* appeared to be best adapted to rapidly flowing streams, the edges of rivers and crevices in rocks, particularly places with little or no vegetation, and *A. minimus* to running water, usually streams with grassy banks. The latter was extremely rare in stagnant water. *A. vagus*, Dön., although ubiquitous, clearly prefers stagnant pools. It is found more or less frequently in running water with vegetation, but avoids clear water with a rapid current. *A. vagus*, with *A. hyrcanus* var. *sinensis*, Wied., is always one of the most numerous species in every breeding-place. *A. jeyporiensis*, James, and *A. aconitus*, Dön., are most often found in running water. The latter, although relatively rare in Tonkin, appears to be ubiquitous and may be found in waters that exist only in the rainy season. *A. fuliginosus*, Giles, prefers breeding-places with abundant vegetation, whether permanent or otherwise. *A. barbirostris*, Wulp, *A. philippinensis*, Ludl., *A. kochi*, Dön., *A. karwari*, James, and *A. aitkeni*, James, show no marked specificity.

PAPERS NOTICED BY TITLE ONLY.

BRUG (S. L.). **Chitinisation of Parasites in Mosquitos.**—*Bull. Ent. Res.*, xxiii, pt. 2, pp. 229–231, 1 pl., 11 refs. London, July 1932.

BONNE-WEPSTER (J.). **A remarkable Malformation in the Male Hypopygium of** *Aëdes* (*Stegomyia*) *albopictus*, **Skuse** [from Sumatra].—*Bull. Ent. Res.*, xxiii, pt. 2, pp. 233–234, 2 figs. London, July 1932.

HINMAN (E. H.). **Enzymes in the Alimentary Canal of Mosquito Larvae.**—*Proc. Soc. Exp. Biol.*, xxix, no. 8, pp. 915–916, 6 refs. New York, May 1932.

CHATTON (E.). **A propos du rôle de la membrane péritrophique des glossines dans l'évolution du trypanosome du crocodile,** *T. grayi* (=*T. kochi*).—*Bull. Soc. Path. exot.*, xxv, no. 6, pp. 575–577, 6 refs. Paris, 1932. [*Cf. R.A.E.*, B, xii, 142 ; xix, 200 ; xx, 19.]

HIRST (L. F.). **Fumigation for Plague Prevention with Special Reference to Colombo Port.**—*Ceylon J. Sci.* (D. Med. Sci.), ii, pt. 5, pp. 277–327, 3 pls., 1 diag., 24 refs. Colombo, 20th May 1932. [Almost entirely a reprint of part of a previous report *R.A.E.*, B, xx, 26.]

DYER (R. E.), WORKMAN (W. G.), RUMREICH (A.) & BADGER (L. F.). **The Preparation of a Vaccine from Fleas** [*Xenopsylla cheopis*, Roths.] **infected with endemic Typhus.**—*Publ. Hlth. Rep.*, xlvii, no. 25, pp. 1329–1331, 7 refs. Washington, D.C., 17th June 1932.

[BURESH (I.) & DRYENSKI (P.).] **Буреш (И.) и Дрѣнски (П.). Beitrag zur Erforschung der Zecken (Ixodidae) Bulgariens.** [Contribution to the Study of Ixodids in Bulgaria. (*In Bulgarian.*)]—*Mitt. bulg. ent. Ges.*, vii, pp. 116–124, 6 refs. Sofia, June 1932. (With a Summary in German.) [Twenty-two species with hosts and distribution.]

JOYEUX (C.) & PIÉRI (J.). **Le lapin peut constituer un réservoir de virus pour la fièvre boutonneuse (exanthématique).**—*C. R. Acad. Sci. Fr.*, cxciv, no. 26, pp. 2342–2343. Paris, 1932.

Sanborn (C. E.), Stiles (G. W.) & Moe (L. H.). **Preliminary Experiments in the Transmission of Anaplasmosis by Horseflies.**—*Bull. Oklahoma Agric. Expt. Sta.*, no. 204, 16 pp., 4 figs. Stillwater, Okla., May 1932.

During 1930, anaplasmosis was transmitted experimentally to a healthy cow subjected to 41 bites by three species of Tabanids, *Tabanus gracilis*, Wied., *T. sulcifrons*, Macq., and *Chrysops sequax*, Will., that had previously fed on an infected animal. Further experiments were therefore undertaken in 1931 in which flies fed on an infected animal were subsequently fed on healthy animals on the same day, or one or more days later.

A cow subjected to 43 bites from 5 species of flies (*T. gracilis*, *T. sulcifrons*, *T. venustus*, O.S., *T. fuscicostatus*, Hine, and *Silvius pollinosus*, Will.) showed the first symptoms of a fatal infection with the disease 38 days after the first bites and 24 days after the last ones. Three other cows subjected, respectively, to 79 bites by *T. gracilis*, 24 bites by *T. sulcifrons* and 115 bites by *T. venustus*, developed symptoms 38, 66 and 73 days after the first feedings, and 30, 60 and 42 days after the last feedings. The first three cows were exposed to flies that had fed on an acute case of anaplasmosis, whereas in the last case the flies had fed on a carrier animal showing relatively few microparasites in its blood. The incidence of anaplasmosis in this territory corresponds with the period of the greatest prevalence of Tabanids, which occurs during July–October, though cases of the disease are occasionally found during other months of the year.

Brief notes on the morphology and habits of these flies are given in an appendix.

Mezquita (M.). **Contribucion al conocimiento de la fiebre recurrente española.** [A Contribution to the Knowledge of Spanish Relapsing Fever.]—*Med. Países cálidos*, v, no. 4, pp. 269–275, 34 refs. Madrid, July 1932.

Two cases of relapsing fever from the Province of Salamanca, Spain, are described, the persons concerned being associated with pigs. Ticks of the genus *Ornithodorus* were found in abundance where one of the patients was accustomed to rest.

Soriano (F.). **Aportaciones al estudio de la fiebre recurrente española.** [Contributions to the Study of Spanish Relapsing Fever.]—*Med. Países cálidos*, v, no. 4, pp. 303–309. Madrid, July 1932.

Notes are given on 21 cases harbouring *Spirochaeta* (*Treponema*) *hispanica*. Many of the patients were swineherds, and the conditions indicate transmission by *Ornithodorus erraticus*, Lucas (*marocanus*, Vélu).

Mooser (H.). *Ornithodorus nicollei* **spec. nov.**—*An. Inst. Biol. Univ. Mexico*, iii, no. 2, pp. 127–131, 6 figs. Mexico, 1932. (With a Description in English.)

Ornithodorus nicollei, sp. n., is described from all stages in the State of Guerrero, Mexico, where it occurs in native huts and attacks man.

SCHULZE (P.). **Die Zecken als Vogelparasiten.** [Ticks as Parasites of Birds.]—*J. Ornith.*, lxxx, no. 3, pp. 318–329, 5 figs., 18 refs. Berlin, 1932.

This discussion of Argasid and Ixodid ticks infesting birds includes a list of those Ixodids of which the adults occur exclusively on birds.

[DRYENSKI (P.).] **Дрѣнски (П.). Kleine entomologische Notizen II.** [Brief entomological Notes ii. (*In Bulgarian.*)]—*Mitt. bulg. ent. Ges.*, vii, pp. 62–77, 4 figs., 10 refs. Sofia, June 1932.

In the summer of 1931 an epidemic of spirochaetosis broke out among the birds of prey in the Zoological Gardens in Sofia, causing the death of a number of valuable individuals. The examination of the cages and surviving birds revealed the presence of enormous numbers of the transmitting tick, *Argas persicus*, Oken, in all stages. On the birds, the ticks, which attached themselves chiefly near the beak, on the neck and under the wings, were eradicated by repeated applications of pyrethrum powder. The cages were sprayed and washed with various disinfectants after the ticks had been swept out of them, but even then some ticks were caught on adhesive smeared on the edges of the perches. The author recommends the transfer of the birds to iron cages from the present wooden ones.

Of 172 horses from the environs of Sofia, slaughtered for the purpose of feeding animals in the Zoological Gardens, 111 were severely infested by larvae of *Gastrophilus*, *G. intestinalis*, DeG., occurring chiefly in the stomach, *G. nasalis*, L., in the duodenum, and *G. haemorrhoidalis*, L., in the rectum. A key is given to the larvae of these three species, and another to the adults, including those of *G. pecorum*, F., which also occurs in Bulgaria.

GORDON (W. S.), BROWNLEE (A.), WILSON (D. R.) & MACLEOD (J.). **Studies in Louping-ill (An Encephalomyelitis of Sheep.) I.**—*J. Comp. Path.*, xlv, pt. 2, pp. 106–140, 7 charts, 11 refs. Croydon, June 1932.

In the first part of this paper, the literature on louping-ill in sheep is reviewed, and experiments are described in which blood from infected sheep was inoculated daily into mice to determine at what period the virus could be recovered from the blood and incidentally when ticks would be infected by feeding. It is concluded that the virus invades the blood stream concurrently with the initial rise in temperature and is present in demonstrable amount during the febrile stage of the disease, and that in most instances a fall in temperature is followed by the disappearance of much or all of the virus from the blood.

In the second part, a field experiment is described in which 48 sheep rendered immune from louping-ill and 49 susceptible sheep (controls) were put on a pasture where the disease was known to occur. All the sheep became infested with ticks (*Ixodes ricinus*, L.), and in every sheep (immune and control) of which a temperature record was kept, a febrile reaction developed. The febrile reaction in immune sheep is attributed to an infective agent transmitted by ticks, and the condition is provisionally named " tick-borne fever." The reaction in the control sheep is attributed, at least in a large proportion of cases, to louping-ill in addition to tick-borne fever. This conclusion is supported by the fact that a greater loss of weight occurred in the controls, their febrile reaction had a shorter incubation period, and 60·9 per cent. of the survivors had acquired immunity from louping-ill and all had acquired immunity from tick-borne fever. The tissues of all the control sheep that died were not examined, as they showed no clinical evidence of infection of the central nervous sytem, which was believed at that time to be the only characteristic of louping-ill. It has since been found that the virus may cause the death of sheep showing no evidence of such infection, and it is probable that many of the control sheep that died were primarily infected with this virus, to which they succumbed. On many infected farms, tick-borne fever probably occurs in individual sheep concurrently with louping-ill, and this may account for some of the difficulties of previous investigators in establishing the etiology of the latter. The significance, if any, of the association of the two diseases is not clear. As a result of subsequent work it was found that the majority of the ticks collected from the experimental pasture harboured the infective agent of tick-borne fever, whereas only a few were proved to harbour the virus of louping-ill.

CARPANO (M.). **Localisations du *Trypanosoma theileri* dans les organes internes des bovins. Son cycle evolutif.**—*Ann. Paras. hum. comp.*, x, no. 4, pp. 305–322, 2 pls., 2 figs., 45 refs. Paris, 1st July 1932.

In the course of this paper on the morphology and development of *Trypanosoma theileri* in the internal organs and blood of cattle, it is pointed out that the forms observed are similar to those of *Crithidia hyalommae* in the coelomic fluid of *Hyalomma aegyptium*, L. [*cf. R.A.E.*, B, i, 163, 199; ii, 45], and the author therefore concludes that this tick is the vector of the trypanosome.

KODAMA (T.). **On a certain Mite belonging to Tyroglyphidae found in Human Excreta and its Eggs. (Abstract).**—*J. Publ. Hlth. Ass. Japan*, vii, no. 10, pp. 1–2; viii, no. 2, pp. 5–6. Tokyo, October 1931 & February 1932.

The author records the occurrence of all stages of a Tyroglyphid in human excreta in Japan. The eggs and adult are briefly described. Mites and eggs were found on three successive occasions in fresh excreta from the same individual, and the author considers that the mite is probably a transient intestinal parasite.

ARAKAWA (Y.). **The Resistance of the Clothes Louse to various Insecticides.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 2, pp. 86–92. Tokyo, May 1932.

The eggs of *Pediculus humanus*, L., proved more resistant to insecticides than the other stages and the larvae more so than the adults. Fumigation with chloropicrin is an effective control measure.

PARENTI (G.). **La città senza mosche.** [The Fly-free Town.]—11 pp., 9 figs. Montecatini, 1932.

It is stated that by spraying all possible breeding-places of *Musca domestica*, L., with a proprietary sweetened arsenical insecticide the town of Montecatini Terme, Italy, has been freed from this fly. Spraying was supplemented by placing rotting fruit or bundles of twigs wetted with the insecticide in all animal quarters and fowl-sheds. In stables *Stomoxys calcitrans*, L., was also eradicated. From 1920 to 1923 53 cases of typhoid, enteritis and dysentery occurred in the town. The work began in 1924, and in 1928–31 only 4 cases occurred.

Séguy (E.). **Notes sur les moustiques, IV.**—*Encyc. ent.*, Sér. B, II, Dipt., vi, pp. 97–102, 3 figs., 11 refs. Paris, 1932.

Certain additions and corrections based on studies carried out by various authors since its original publication are given for insertion into a work on the mosquitos of France previously noticed [*R.A.E.*, B, xi, 174], together with the corresponding bibliography.

Symes (C. B.). **Descriptions of Fourth Stage Larvae of certain Anophelines of East Africa, with brief Notes on Breeding, Distribution and Economic Importance.**—*Rec. Med. Res. Lab. Kenya*, no. 2, 78 pp., 32 pls. Nairobi, 1932.

Previous descriptions of larvae of East African Anophelines are scattered throughout the literature, and many of them are in a form inconvenient for workers engaged in the routine examination of large numbers of larvae from widely separated districts. For this reason the author gives descriptions of the fourth-stage larvae of 25 species from Kenya and Uganda with a key, and, in most cases, notes on distribution, breeding-places, habits and relation to malaria. Among the mosquitos examined for malarial parasites, sporozoites were found only in *Anopheles gambiae*, Giles, and *A. funestus*, Giles.

Watson (Sir M.). **The Enemy in Rhodesia. Combating the Mosquito. A Successful Year.**—*The Times*, 1st July 1932, reprint 3 pp. London, 1932.

An account is given of the control of malaria in the copper mines of Northern Rhodesia from October 1929 to 1932. The breeding-places of the two vectors, *Anopheles gambiae*, Giles, and *A. funestus*, Giles, are briefly described. In the case of the latter, breeding may take place in springs that suddenly arise above the usual swamp line, hidden in grass 2–10 ft. high. It increases in numbers from the beginning of the rains in November until April, but the cold, dry weather in May and June rapidly induces hibernation. The malaria wave begins in October, rises steadily until April and subsequently falls rapidly to its minimum in August. In December 1929, 95 per 1,000 Europeans were attacked by malaria, but the oiling of pools against *A. gambiae* was so effective that the rate, instead of rising, fell steadily until August 1930. In April 1930, no larvae of this species were found in the controlled area. On the other hand, the control of *A. funestus* involved the clearing of six miles of river and the drainage of 400 acres of swamps. In the exceptionally rainy season of 1930–31, *A. funestus* took advantage of weak places in the drainage system and caused an outbreak of malaria that affected 50 per 1,000 persons in March 1931. The correction of the defects, however, reduced the rate to less than 19 per 1,000, of which more than half were cases of relapse or of persons who had contracted infection elsewhere. With the decrease in malaria there has been a reduction in the amount of illness from other diseases. The author concludes that *A. gambiae* can be dealt with easily and at little expense, but that the control of *A. funestus* is difficult and costly where there is much swamp. This difficulty may be overcome by selecting sites for dwellings at least half-a-mile from swamps and rivers.

Hoffmann (C. C.). **On *Anopheles pseudopunctipennis* and its Relation to Malaria in Mexico.**—*Southern Med. J.*, xxv, no. 5, pp. 523–527. Birmingham, Ala., May 1932.

This paper deals chiefly with the distribution, seasonal activity and breeding-places of the four most important vectors of malaria in Mexico [*cf. R.A.E.*, B, xvii, 73, 217, etc.]. The Nearctic species, *Anopheles crucians*, Wied., and *A. quadrimaculatus*, Say, play a relatively small part in the transmission of the disease, and the regions of dangerous activity of the southern species, *A. albimanus*, Wied., are restricted to well defined areas of the littoral, moist and hot lowlands and areas immediately adjacent. The presence of endemic malaria over an enormous part of the centre of the country, which is characterised by a more or less dry climate and includes the high valleys, 6,000–7,000 ft. above sea level, is due to *A. pseudopunctipennis*, Theo. This species, which is perfectly adapted to dry climates, remains active throughout the dry winter months and is the principal cause of winter malaria, particularly in the southern and western parts of the country. A chart is appended in which the author divides the country into seven malarious zones and shows the species of Anophelines found, the vectors of malaria and the type of the disease that predominates in each.

Mayne (B.). **Some recent Investigations of the Viability and Longevity of the Malaria Parasite in the Mosquito as related to Malaria Therapy of Paresis.**—*Southern Med. J.*, xxv, no. 5, pp. 549–551. Birmingham, Ala., May 1932.

After pointing out reasons for increasing the employment of mosquitos in inducing malaria in paralytics, the author reviews the modifications of treatment used by English workers and discusses the longevity of the mosquito, the length of time it remains infective, the question of transportation, and the effect of temperature on the conservation of different stages of the malaria parasite within the insect host. The possibility of utilising suspensions of sporozoites with a view to obviating the difficulty of transporting living mosquitos is also mentioned.

Thomson (E.). **A Possible Means of Cutting down the Mosquito Population.**—*Science*, lxxv, no. 1933, pp. 78–79. New York, 15th January 1932.

In the operation of a large electric furnace in Massachusetts, it was noted that large numbers of male mosquitos were attracted to the spot and died from the heat. A possible explanation is that the hum of the heaters in the furnace, caused by a 3-phase 60 cycle current, is identical in pitch with that of the female mosquito. It is suggested that a suitable inexpensive apparatus that would emit this note might be of service in attracting and controlling mosquitos.

Hinman (E. H.). **The Presence of Bacteria within the Eggs of Mosquitos.**—*Science*, lxxvi, no. 1961, pp. 106–107, 1 ref. New York, 29th July 1932.

Examples are given of cultures of eggs of *Aëdes argenteus*, Poir. (*aegypti*, auct.), kept and hatched under completely sterile conditions [*R.A.E.*, B, xx, 173], developing a spontaneous contamination of bacteria. The average length of time the cultures remained sterile before the appearance of contamination was 9 days. The organisms isolated included gram-negative and gram-positive bacilli, staphylococci and yeast. Only in cases where the hatching of certain of the eggs was delayed for several days could this phenomenon be demonstrated. In the author's opinion the only possible explanation is that bacteria were present in the eggs that were delayed in hatching and multiplied rapidly in the bouillon when the larvae hatched. To test this hypothesis a considerable number of eggs of *A. argenteus* and other mosquitos were sectioned and stained ; and the presence of bacteria was demonstrated in a number of slides. Experiments as to hereditary transmission of the virus of yellow fever or of dengue in the mosquito have so far yielded negative results, with a single doubtful exception, but if viable bacteria may occasionally be recovered from the eggs of *A. argenteus*, it is possible that the virus of yellow fever or dengue might, in certain circumstances, appear in the eggs of infected females.

DAVIS (N. C.). **The Effects of Heat and of Cold upon** *Aëdes* (*Stegomyia*) *aegypti*.—*Amer. J. Hyg.*, xvi, no. 1, pp. 177–191, 19 refs Baltimore, Md., July 1932.

Details are given of experiments to determine the effect on eggs of *Aëdes argenteus*, Poir. (*aegypti*, auct.) of exposure to temperatures ranging from —5·5 to 45°C. [22·1 to 113°F.] It was found that actual freezing kills both fresh eggs (less than 24 hours old) and mature eggs (about 3 days old) after a relatively short exposure (48 hours), fresh eggs being slightly more resistant, and that a temperature of 10°C. (50°F.) has a very deleterious effect on fresh eggs. At 40°C. [104°F.] fresh eggs were killed in 48 hours and mature eggs in less than 7 days ; and at 45°C. all eggs were killed in 24 hours. Unfortunately, in nature, it is probable that the majority of eggs are deposited in sheltered places, where they are not subjected to extremes of either winter or summer temperatures.

In the second part of the paper the author deals with the effect of heat and cold on the vital activities of the adults. Temperatures of 36°C. [96·8°F.] or above greatly shortened the length of life ; a colony kept breeding at this temperature was unable to maintain its numerical strength and died out in less than two months, despite high humidity and access to water and food. There was also a markedly deleterious effect upon the larvae and pupae. A colony kept at 18–19°C. [64·4–66·2°F.] carried on all vital activities satisfactorily and maintained or even augmented its numerical strength.

FREEBORN (S. B.). **The seasonal Life History of** *Anopheles maculipennis* **with Reference to Humidity Requirements and "Hibernation."**—*Amer. J. Hyg.*, xvi, no. 1, pp. 215–223, 3 graphs, 5 refs. Baltimore, Md., July 1932.

An account is give of further observations [*R.A.E.*, B, x, 65] and of laboratory experiments on *Anopheles maculipennis*, Mg. (*occidentalis*, D. & K.). There are six generations a year in the central Sacramento Valley of California, the adults of the second and possibly the third generation living a life too short to transmit malaria. Those of the first generation, from eggs laid by overwintering females, begin to appear during the last week in April or the first week in May, and the numbers taken in the weekly collections increase until the third week in June. A decrease occurs in the number of adults between June and

September and is the result of unfavourable weather conditions, being brought about when the maximum daily temperature is in excess of 90°F. and the daily evaporation from a white ball atmometer is more than 70 cc. Adults are most abundant during the last weeks in September. The numbers then decrease, and the semi-hibernation period begins in November, when the last males are taken; this lasts until late January or early February, when the overwintering females emerge for their spring flight. The mid-summer decrease in the number of adults is not reflected in the larval collections, in which the numbers increase progressively in each generation.

Increased humidity has a protective influence on the longevity of laboratory specimens kept at constant temperatures, but at 80°F. no amount of relative humidity protects them for more than a few days. At 76°F. a relative humidity of 80 per cent. protects them for more than a month, and at 70°F. 55 per cent. relative humidity enables them to live for the same time. The saturation deficiency at 70°F. with 55 per cent. humidity is 3·6 grains per cu. ft., but at 80°F. with 80 per cent. humidity it is only 2·2, and in order to explain why greater saturation deficiencies are tolerated at lower temperatures, it is suggested that the water-binding power of an insect is a function of the temperature.

The so-called " prehibernation " adults that appear during October and early November are robust, slightly larger and decidedly darker in colour than the spring and summer forms. They migrate for many miles and invade areas that have been free from mosquitos during the summer. Collections of females made near breeding grounds at this time often yield individuals that will lay eggs as a result of feeding, but none of those of the migrant form developed eggs before January, any nutriment being invariably taken up by the fat-body. They are active throughout the winter, particularly on warm days, and about 20th February they begin to bite viciously either by day or by night, and oviposition follows. They disappear completely about the second week in March, and until the emergence of the first generation the entire population of *A. maculipennis* is in the larval stage. The stimulus for the production of this migratory, melanotic phase is obscure. It is possible that migration would end in oviposition if cold weather did not intervene. The findings of Kligler and Mer [xix, 123; xx, 192] that these migrating forms may transmit malaria are confirmed to some degree by the author's records of three apparently new cases of malaria contracted during January and February, one of them in a week-old infant.

HACKETT (L. W.), MARTINI (E.) & MISSIROLI (A.). **The Races of *A. maculipennis*.**—*Amer. J. Hyg.*, xvi, no. 1, pp. 137–162, 5 figs., 16 refs. Baltimore, Md., July 1932.

The authors discuss the question of racial differences in *Anopheles maculipennis*, Mg., in Europe and point out that the distinction of races on the basis of average measurements of some structural character is not serviceable in identifying individual specimens nor in determining the racial composition of a given population. On the other hand the authors' observations in many areas of Germany and Italy have confirmed and extended Falleroni's conception of division by means of the markings and structural peculiarities of the eggs [*cf. R.A.E.*, B, xx, 57]. One race (*A. maculipennis* var. *labranchiae*, Fall.) lays a uniformly dappled egg with relatively small floats placed posteriorly. The egg occurs as a light grey type in Italy (but never in pure culture), and as a dark grey type in North Germany, where this race is the only one present in certain areas. It has been found almost exclusively in low-lying brackish marshes near the sea, or in inland areas where the water has a relatively high salinity. It also occurs in all areas so far studied where malaria is actually or potentially present, and it appears to be relatively more prevalent in dwellings than the other race. It does not hibernate completely and is relatively active in houses and stables throughout the winter even in northern Europe. It seems to be the same as *A. maculipennis* var. *atroparvus*, van Thiel, and has definite affinities with *A. sacharovi*, Favr (*elutus*, Edw.). The second race (*A. maculipennis* var. *messeae*, Fall.) lays an egg irregularly pigmented in bars and angular patches, but including always two heavy transverse bands just distal to the ends of the float structures, which latter are relatively large and long. This race occurs in inland fresh waters in Italy and Germany, in the proportion of 95 per cent. of the entire local population of *A. maculipennis*, and each variation except pure black has been found in pure strains in several regions. It predominates in non-malarious areas, frequents stables more than dwellings and hibernates completely in winter. Structural differences between the eggs, larvae and male hypopygia of the two races have been described [*R.A.E.*, B, xx, 119].

ROUBAUD (E.). **Recherches sur les variations trophiques et biologiques des peuplements de l'***Anopheles maculipennis.* **Etude préliminaire.** —*Bull. Soc. Path. exot.*, xxv, no. 7, pp. 755–762, 6 figs., 1 ref. Paris, 1932.

The author has undertaken a comparative study of about 15 different strains of *Anopheles maculipennis*, Mg., from various malarious and non-malarious regions, which are being reared under identical conditions. In the first experiment the attractiveness exerted by man and animal was tested in each strain by placing successively a human forearm and hand or a guineapig with a shaved back into the cage and noting the time taken by the females to respond by attacking one or the other. Only three strains (obtained from the Pontine marshes, Murcia in Spain and Algeria) manifested a marked preference for human blood (undifferentiated zoophilism), and all belonged to the paucidentate type with a maxillary index of less than 14 [*R.A.E.*, B, xvi, 210; xix, 162; xx, 151]. All the other strains showed an index of more than 15 and attacked guineapigs in preference to man (differentiated zoophilism). The strains with a high index engorged on a guineapig in 2–2½ mins. whereas those with a low index took 3–4 mins. Moreover, certain individuals from Algeria with an index of less than 13 were not able to feed on a guineapig after three attacks of a quarter of an hour, repeated on three successive days, whereas individuals with 15–16 teeth belonging to the same strain engorged in 1½–3 mins. These tropisms as well as the relative maxillary differentiation persisted in the progeny of the mosquitos, which were observed in most cases up to the fourth generation.

Observation on the manner of hibernation in the females confirms and generalises the findings based on studies of two races in Holland [xviii, 52]. Strains from Murcia, the Pontine marshes and the large type from Holland appear to be homodynamic; the suspension of oviposition in this case is due simply to the influence of cold, and females of these races have been induced to oviposit in January by exposure for about a week to a temperature of 20°C. [68°F.]. On the other hand, the greater number of strains studied are heterodynamic ; the females are subject in winter to a spontaneous ovarian inertia (asthenobiosis), and oviposition is generally suspended for several weeks and cannot be re-induced by exposure to heat. The lack of relation between the growth of the ovules and the blood meals of the females during the winter is termed by the author arhythmic trophogenesis and corresponds to Swellengrebel's gonotrophic dissociation [xviii, 53]. The ability of a species of insect to produce races with different metabolic capacities under identical exterior conditions is designated poecilobiosis. The Dutch authors' observations on the amount of space necessary for pairing [xviii, 228] were confirmed, for it was extremely difficult or impossible to obtain fertilisation of strains from the Pontine marshes or Murcia in a confined space, whereas pairing took place regularly in the case of strains from France, England, Holland (*A. maculipennis* var. *atroparvus*, van Thiel), etc. These races are called eurygamic and stenogamic respectively. Pairing of the eurygamic races readily occurred in a larger space.

From the point of view of malaria, the eurygamic, homodynamic races that have not developed a zoophilic tendency are the dangerous vectors during the normal epidemic period (the eurygamic, homodynamic large race in Holland is, however, zoophilic), but the stenogamic, heterodynamic races, which appear to show marked zoophilism, may be dangerous vectors during winter when the females in heated dwellings or shelters continue to suck blood. This transmission depends to a great extent on the artificial temperature of the dwellings, and in Europe nowadays appears to be of only secondary importance.

SENEVET (G.) & TRENSZ (A.). **A propos de l'*Aëdes mariae* (Sergent, 1903).**—*Bull. Soc. Path. exot.*, xxv, no. 7, pp. 702–709, 4 figs., 11 refs. Paris, 1932.

In view of the fact that the authors have bred adults typical of *Aëdes mariae* Serg., from larvae obtained in Algeria showing the characters attributable to *A. zammittii*, Theo., they consider that the latter should be treated as a synonym of the former. The pupa is described.

FONQUERNIE (J.). **Les puces domestiques à Tananarive (Note complémentaire).**—*Bull. Soc. Path. exot.*, xxv, no. 7, p. 710. Paris, 1932.

The author presents evidence demonstrating the rarity of *Xenopsylla cheopis*, Roths., in houses in Tananarive [*R.A.E.*, B, xx, 203] even immediately after the incidence in them of cases of plague.

ROUBAUD (E.) & COLAS-BELCOUR (J.). **Observation sur la biologie de l'*Anopheles plumbeus*. I. Le comportement larvaire.**—*Bull. Soc. Path. exot.*, xxv, no. 7, pp. 763–770, 1 pl., 15 refs. Paris, 1932.

Experiments are described in which larvae of *Anopheles plumbeus*, Steph., were reared in the laboratory under varying conditions. These larvae usually occur in tree-hole water that is yellow or reddish-brown, and it was found that water containing tannin and dissolved organic material attracted ovipositing females but that eggs were occasionally deposited in pure water, a fact confirmed by unusual breeding-places observed in nature. When provided with suitable food, the larvae develop in the same period of time whether tannin is present or not. The larvae, normally negatively phototropic, may acquire a certain degree of positive phototropism when brought into the light, but rapidly re-acquire their normal response when replaced in the dark. The extremity of the lower caudal hairs is provided with a short hook that enables the larvae to maintain the characteristic vertical attitude by attaching themselves to the walls of the breeding-place during the time of submergence in winter. The larvae are able to complete their development even when the water is so dried up as to prevent their swimming freely, but the time taken is longer than in larger amounts of water, and it is possible that an accumulation of excretory products and competition for nourishment are concerned [*cf. R.A.E.*, B, xi, 162 ; xix, 82].

TOUMANOFF (C.). **Contribution à l'étude de la faune anophélienne d'altitude au Tonkin.**—*Bull. Soc. Path. exot.*, xxv, no. 7, pp. 770–788, 24 figs., 5 refs. Paris, 1932.

Descriptions are given of the adults and larvae of *Anopheles gigas* var. *baileyi*, Edw., and *A. lindesayi*, Giles, and of the larva of *A. aitkeni*, James, with notes on the seasonal incidence and distribution in Tonkin of these and the other mosquitos mentioned in a previous paper [*R.A.E.*, B, xx, 133]. *A. gigas* var. *baileyi* and *A. lindesayi* were found solely in breeding-places with running water, and appeared to show no preference for any particular type. They are the most numerous species in the high region and together constitute 43·44 per cent. of the larval population in August and December. *A. lindesayi* is common in summer, and *A. gigas* var. *baileyi* more frequent in winter. The latter does not appear to be strictly limited to high altitudes and has been found in winter at about 146 ft. above sea level.

SENIOR-WHITE (R.) & NEWMAN (C. D.). **Studies in Malaria as it affects Indian Railways. Part II.**—*Tech. Pap. Railway Bd. India*, no. 258, pt. 2, vi+71 pp. Calcutta, Govt. India Cent. Pub. Br., 1932. Price 1*s.* 6*d.*

The first section of this paper, of which Part I has already been noticed [*R.A.E.*, B, xvi, 188], is a translation of a lecture by Dr. A. Filippini at the Advanced School of Malariology at Rome on the subject of malaria in relation to the Italian Railways. The morbidity among the railway staff reflects in a general way the malaria incidence in the country through which the railway runs. The construction of railways with the consequent aggregation of workmen and the alteration of the surface of the land, with the formation of borrow pits and the obstruction of natural water flow, creates conditions favourable for the increased transmission of malaria. Many of these conditions persist during the operation of the railway, and in addition infected Anophelines may be carried from malarious to healthy places on the trains. It is frequently necessary for railway maintenance staffs to live in uninhabited malarious country from which the local population departs at night, and the running staff on the trains are exposed to infection in the malarious localities through which they pass. The economic losses due to malaria are discussed, and measures undertaken before the discovery of Anopheline transmission are briefly reviewed, together with the early experiments in screening and quinine prophylaxis. The present measures consist in delimiting malarious areas and making records of infected employees, screening all buildings in malaria zones, administering quinine, various anti-larval measures (such as filling, draining, oiling, etc.), the provision of medical service, propaganda work, and the supply of financial aid to employees in highly malarious places. Measures that should be taken during the construction of a railway are briefly mentioned and include avoiding the formation of borrow pits, or if this is not possible, arranging for their drainage, the use of oil or Paris green on unavoidable water collections, and the housing of employees in mosquito-proofed quarters in camps.

In the second section the authors discuss the bearing of various aspects of Filippini's paper on the malaria conditions affecting Indian railways. Screening is considered desirable, particularly in the case of small stations where there is little night traffic. The fact that short range larval control measures restricted to railway land considerably reduced malarial incidence in Italy despite the great flight power of *A. maculipennis*, Mg., emphasises the importance of breeding-places within 400 yards as compared with more distant ones, but it seems that if short distance anti-larval measures are not combined (as in Italy) with screening and the administration of quinine, little benefit from them will be apparent. Owing to these measures, the gametocyte rate in Italy is low and the breadth of contact between man and mosquito is greatly reduced. In India the breadth of contact is unlimited, and the generally high gametocyte rate ensures a considerable infection rate in mosquitos. Hence attention to such primary foci alone would prove much less effective, though it might be of value in such places as small stations in jungle areas remote from villages.

Regarding the transport of Anophelines by train, 609 individuals of *Anopheles ludlowi* var. *sundaica*, Rodenw., were captured in trains running from a newly discovered breeding-place of this species to a suburb of Calcutta during the last fortnight in August, and of the second week's catch, 7 per cent. were found to be infected with malaria parasites. Cases of malaria occurred in that neighbourhood of Calcutta shortly afterwards.

In an appendix entitled " Malaria Control on Constructions " W. H. C. Kelland describes various types of railway construction systems and outlines what he considers the most practical method for use in India.

Corner (J. D.). **The Employment of the Portable Pump in Anti-malaria Schemes.**—*J.R.A.M.C.*, lix, no. 2, pp. 138–141, 3 figs. London, August 1932.

The author describes the satisfactory use of two small, hand-operated, rotary pumps for the drainage of Anopheline breeding-places formed by monsoon and post-monsoon rain water in a locality in India where temporary drains were ineffective owing to the nature of soil and permanent drainage was impossible on financial grounds.

Russell (P. F.) & West (A. P.). **Charcoal as a diluent for Paris Green in the Destruction of *Anopheles* Larvae. Larvicide Studies.**—*Philipp. J. Sci.*, xlviii, no. 3, pp. 291–296, 1 pl., 5 refs. Manila, 1932.

In such places as the Philippines where charcoal is cheap, its use is recommended as a diluent for Paris green employed as a mosquito larvicide. It is readily obtainable, easily powdered and mixed, floats longer than Paris green, is visible after application, easily distributed and inexpensive. In laboratory tests a mixture of Paris green and charcoal appeared to be as effective against larvae of *Anopheles subpictus*, Grassi, and *A. hyrcanus* var. *sinensis*, Wied., as Paris green mixed with either lime or rice-stalk ashes For ordinary purposes, a mixture of 1 part Paris green to 99 parts charcoal (by volume) is effective when used at the rate of 0·1 cc. Paris green to 1 sq. metre.

FENG (Lan-chou). **Investigations of Malaria and its Transmission in Amoy, Fukien Province, South China.**—*J. Trop. Med. & Hyg.*, xxxv, nos. 13–14, pp. 198–202, 214–221, 1 pl., 3 figs., 1 map, 1 chart, 30 refs. London, July 1932.

The following is taken from the author's summary : A brief investigation of Anopheline mosquitos and malaria carried out in various parts of Amoy Island, indicated that the disease is endemic in the villages near the hills and probably to a much less degree in the town of Amoy. The five species of Anophelines found, in order of frequency, were *Anopheles minimus*, Theo., *A. jeyporiensis*, James, *A. hyrcanus* var. *sinensis*, Wied., *A. maculipalpis*, Giles, and *A. maculatus*, Theo., of which only the first two were found infected with malarial parasites. The positive findings of natural infection in these mosquitos are apparently the first to be recorded in China. *A. minimus*, which appears to be the most important vector, though *A. hyrcanus* var. *sinensis* and *A. maculatus* are suspected of transmitting the disease at other seasons, was found responsible for an epidemic of malaria among a group of 200 workers living among the foothills of the island, and in this area showed an oöcyst infection of 8·57 per cent. and a sporozoite rate of 29·85 per cent. A smaller number caught in endemic villages showed only 4 per cent. oöcyst infection. From the appearance of the pigment in the younger oöcysts the infection may be considered to be mostly *Plasmodium falciparum*, although *P. vivax* and *P. malariae* were also found both alone and in combination.

Natural infection of *A. hyrcanus* var. *sinensis* is reported for the first time from Woosung and Soochow, Central China, where the author was bitten by this mosquito and developed typical benign tertian malaria 15 days later in Peking. A modified method of examination of the salivary glands of mosquitos for sporozoites is described.

MORISHITA (K.). **Comparison of Formosan Anophelines with Related Forms from India and Malaya with Regard to the Problem of their Identification.**—*J. Med. Ass. Formosa*, xxxi, no. 2 (no. 323), pp. 176–204. (With a Summary in English.)

KOIDZUMI (M.) & MORISHITA (K.). **The Identification of the Formosa Anophelines.**—*T.c.*, no. 3 (no. 324), pp. 283–288. (With a Summary in English.) Taihoku, Formosa, February & March 1932.

These papers deal with the nomenclature of the more common and important Anopheline mosquitos of Formosa, the synonymy being confined in the second paper to names that have been used in the literature referring to specimens collected in the Japanese Empire. The species dealt with include *Anopheles hyrcanus* var. *sinensis*, Wied. (*vulgare*, Hatori), *A. minimus*, Theo., *A. jeyporiensis* var. *candidiensis*, Koidz., *A. ludlowi*, Theo. (*ludlowi* var. *formosaensis*, Koidz., *hatorii*, Koidz.), *A. fuliginosus*, Giles, *A. tessellatus*, Theo. (*formosae*, Hatori, *kinoshitai*, Koidz., *taiwanensis*, Koidz.) and *A. maculipalpis* var. *splendidus*, Koidz., The authors agree with Christophers in regarding *A. hanabusai*, Yam., as a synonym of *A. maculatus*, Theo., but consider that *A. willmori*, James, should also be treated as a synonym and not as a variety [*R.A.E.*, B, xix, 206]. They also agree with Christophers in treating *A. japonicus*, Yam., as a variety of *A. lindesayi*, Giles, but consider that *A. pleccau*, Koidz., is a synonym, not a variety, of the latter species [*loc. cit.*]. The form *japonicus*, however, does not occur in Formosa, Yamada's record of it for that country [xiv, 13] actually referring to *A. lindesayi* (*pleccau*).

MORISHITA (K.). **The Eggs of the Formosan Anophelines.**—*J. Med. Ass. Formosa*, xxxi, no. 3 (no. 324), pp. 331–340, 1 pl. Taihoku, Formosa, March 1932. (With a Summary in English.)

The eggs of *Anopheles hyrcanus* var. *sinensis*, Wied., *A. minimus*, Theo., *A. fuliginosus*, Giles, *A. vagus*, Dön., *A. ludlowi*, Theo., *A. maculatus*, Theo., and *A. tessellatus*, Theo., are described from Formosan specimens, and compared with descriptions of examples from India. Brief notes are given on the incubation periods and on the numbers of eggs laid.

AVÉ LALLEMANT (G. F.), SOERONO (M.) & STOKER (W. J.). **Proeven over de vliegwijdte van enkele Anophelinen. (Tweede mededeeling.)** [Experiments on the Flight-range of some Anophelines. (Second Communication.)]—*Meded. Dienst Volksgezondh.*, xxi, no. 2, pp. 17–20. Batavia, 1932. (With a Summary in English.)

In further experiments on the range of flight of Anophelines in Java [*R.A.E.*, B, xx, 67], the previous maximum distance of 880 yards of the buffalo sheds for recapturing stained mosquitos was increased to 1,100 and 1,600 yards. Three examples of *Anopheles aconitus*, Dön., were taken at 980 yards ; one of *A. subpictus*, Grassi (*rossi*, Giles) and two of *A. hyrcanus* var. *sinensis*, Wied., at 1,600; and one of *A. kochi*, Dön., and two of *A. tessellatus*, Theo, at 1,100. In night catches *A. hyrcanus sinensis* represented 34 per cent. of the mosquitos in buffalo sheds and 14 per cent. of those in houses, the corresponding figures for *A. aconitus* being 9·78 and 26·25. Of 147 Anophelines taken in buffalo sheds in which only men were present, 37 (25 per cent.) were *A. aconitus*, thus proving the preference of this species for man. *A. subpictus* was represented in night catches by 25·71 per cent. in sheds and 39·83 in houses, the figures by day being 84·5 and 92. In sheds containing only men, however, it was so rare as to confirm the negligible attraction of man for it. Of 1,000 specimens of this mosquito dissected only 1 appeared to have oöcysts of malaria in the stomach.

SOERONO (M.)., AVÉ LALLEMANT (G. F. M.), & SOESILO (R.). **De stand van de malaria in de Tjiheavlakte.** [Malarial conditions in the Tjihea Plain.]—*Meded. Dienst Volksgezondh.*, xxi, no. 2, pp. 21–27. Batavia, 1932. (With a Summary in English.)

Between 1891 and 1904 about 13,600 acres of the Tjihea plain in Java were opened to irrigation, but adequate discharge of the water was not provided for. The ground was never dry, and planting of rice was continuous. *Anopheles aconitus*, Dön., increased, malaria became rife, and many inhabitants left the district, the breeding of this mosquito being then further promoted in the inundated fields left fallow. As a result, however, of the work carried out since 1919 [*R.A.E.*, B, xii, 47] conditions are now satisfactory.

ESSED (W. F. R.). **De gezondmaking van Banjoewangi, een typisch voorbeeld van species-assaineering volgens Swellengrebel.** [Successful Malaria Control at Banjoewangi, a typical Example of Species Sanitation as conceived by Swellengrebel.]—*Meded. Dienst Volksgezondh.*, xxi, no. 2, pp. 41–50, 1 pl. Batavia, 1932. (With a Summary in English.)

In a report on malaria at Banjoewangi, a town of nearly 23,500 inhabitants on the east coast of Java, measures were advocated against *Anopheles ludlowi*, Theo., breeding in fishponds, *A. aconitus*, Dön., being unimportant there [*R.A.E.*, B, xvii, 223]. The work was done in 1928. After the removal of the dykes erected to form the ponds and the consequent admittance of tidal water to the lagoon where they were laid out, most of the ponds were free from floating algae and larvae. From the end of 1929 both larvae and adults of *A. ludlowi* disappeared entirely, and a mangrove forest is now growing on the site of the ponds. Larvae of *A. ludlowi* and *A. subpictus*, Grassi (*rossi*, Giles) are absent owing to the lack of microplankton at the surface of the water. *Haplochilus panchax*, a fish that destroys mosquito larvae, has also disappeared, as it cannot breed in the absence of submerged aquatic plants to which it attaches its eggs.

JURGENS (A. L.). **De overbrenging van *Filaria malayi* in de onderafdeeling Mamoedjoe.** [The Transmission of *F. malayi* in the Mamoedjoe Subdivision.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 15, pp. 953–959, 5 refs. Batavia, 19th July 1932.

Filarial infection, chiefly due to *Filaria malayi*, is rife in the Mamoedjoe subdivision on the west coast of Celebes, and an investigation to ascertain the vectors was made in two localities where this filaria alone is present and shows an infection index in man of 46 and 37 per cent. respectively. Experiments in infecting mosquitos were made in both localities, and their natural infection was investigated in the second one. *Anopheles barbirostris*, Wulp, appeared to be a very good carrier, with an artificial infection index of 83 per cent. and a natural one of 8·9, both being sometimes observed in the proboscis. *Mansonia* (*Mansonioides*) *annulipes*, Wlk., which is a proved vector [*R.A.E.*, B, xviii, 206], was present in small numbers, with corresponding indices of 64 and 2·7 per cent. In the author's experiments, the filaria appeared to develop more readily and rapidly in *A. barbirostris* than in *M. annulipes*, the minimum development period being 6½ days. *A. punctulatus*, Dön., may possibly be a carrier; it was very rare in the district, but of 6 individuals tested 2 became positive after 9½ days. Artificial infection was unsuccessful with a species of *Aëdes* that was very abundant.

KOPSTEIN (F.). **De rattendichtheid als factor in de epidemiologie der builenpest.** [Rat Density as a Factor in the Epidemiology of Bubonic Plague.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 15, pp. 960–967. Batavia, 19th July 1932.

Examinations of 7,852 native dwellings in West Java, in which over 1,000 were revisited 2–5 times to check results, showed that rat density tends to remain constant in a given place, unless affected by epizootics, hardly any variation being found over a year. *Xenopsylla cheopis*, Roths., was the only flea regularly parasitising the house rat, *Mus* (*Rattus*) *rattus diardii*, but the evidence obtained did not warrant connecting the *cheopis* index and the number of infested rats with the rat density. Nor was there any evidence of a reliable connection between changes in rat density and bubonic plague in man. Rat density was noticeably higher in plague-free localities than in those in which plague had occurred. Just as a high flea index is no proof of the existence of rat plague, so a low rat density by itself is no proof of the existence of an epizootic, though changes in density, together with other suspicious factors, may serve to indicate that a high mortality of rats is taking place.

HALL (D. G.). **A new biting Culicoides from Saltmarshes in the south-eastern States.**—*Proc. Ent. Soc. Wash.*, xxxiv, no. 6, pp. 88–89, 1 fig., 1 ref. Washington, D.C., June 1932.

Male specimens collected in Honduras and determined by Hoffman as *Culicoides furens*, Poey, a species described from females taken in Cuba, were found to differ from males of what has hitherto been considered the same species collected along the south-eastern Atlantic Coast of the United States, where it is of considerable importance as a pest. The latter species is now described as *Culicoides dovei*, sp. n., as it seems better to regard the one occurring in the type locality as the true *C. furens*, though its status is uncertain. The author considers it likely that the specimens from Central America may represent a third species.

POULTON (W. F.). **Annual Report of the Veterinary Department, Uganda, 1931.**—Fol. 23 pp. Entebbe, 1932.

A brief account is given of the reclamation work carried out during 1931 in a section of south Ankole infested with *Glossina morsitans*, Westw. [*cf. R.A.E.*, B, xvii, 120]. The operations were designed to test the theory that the fly might be eliminated over a wide area by clearing primary foci alone (as distinct from clearing the entire "fly belt"). The clearings amounted to about 23 square miles and affected directly areas of approximately 850 square miles. The clearings themselves are now free from fly, and there has been no corresponding increase in uncut areas, where the fly also appears to have been reduced in numbers. In one case 90–100 flies were taken by two collectors in a car on a 5-mile stretch of uncut scrub in May, whereas only 5–10 flies were taken in this way in the same area in December. The recovery of scrub in the cleared areas has been slow, and, if fire control is continued, the necessity for maintenance gangs in the future is not anticipated. Controlled grass-burning has been successfully instituted, and in future one annual burning will probably replace the two previously carried out. The two original smoke houses [*loc. cit.*] have proved satisfactory, and a third has now been erected to fumigate traffic coming from infested areas of Belgian Ruanda.

In an appendix R. W. M. Mettam, Veterinary Pathologist, records the occurrence during November of serious mortality among sheep due to a condition resembling Nairobi sheep disease [xx, 20].

A list is given of 41 species of ticks recorded from Uganda, together with the hosts on which they were taken.

Papers noticed by Title only.

Cowan (F. A.). **A Study of Fertility in the Blowfly,** *Phormia regina* **Meigen.**—*Ohio J. Sci.*, xxxii, no. 4, pp. 389–392, 8 refs. Columbus, Ohio, July 1932.

Shiraki (T.). **Some Diptera in the Japanese Empire, with Descriptions of new Species (1). Tabanidae.**—*Trans. Nat. Hist. Soc. Formosa*, xxii, no. 121, pp. 259–280, 8 figs. Taihoku, Formosa, August 1932.

Philip (C. B.). **The Tabanidae (Horseflies) of Minnesota with special Reference to their Biologies and Taxonomy.**—*Tech. Bull. Minnesota Agric. Expt. Sta.*, no. 80, 132 pp., 4 pls., 3 figs., 83 refs. Univ. Farm, St. Paul, Minn., June 1931. [Recd. September 1932.]

Hearle (E.). **The Blackflies of British Columbia (Simuliidae, Diptera).**—*Proc. Ent. Soc. Br. Columbia*, no. 29, pp. 5–19, 7 figs., 10 refs. Vancouver, B.C., 1932.

Herms (W. B.) & Frost (F. M.). **A comparative Study of the Eggs of Californian Anophelines** [*Anopheles pseudopunctipennis*, Theo., *A. maculipennis*, Mg., and *A. punctipennis*, Say].—*J. Parasit.*, xviii, no. 4, pp. 240–244, 3 pls., 4 refs. Urbana, Ill., June 1932.

Frost (F. M.). **A comparative Study of the Male Terminalia of Californian Anophelines** [*Anopheles pseudopunctipennis*, Theo., *A. maculipennis*, Mg., and *A. punctipennis*, Say].—*J. Parasit.*, xviii, no. 4, pp. 282–284, 3 figs., 2 refs. Urbana, Ill., June 1932.

Bradley (G. H.). **Observations on some Factors associated with the Breeding of** *Anopheles* **Mosquitoes in Northeastern Louisiana.**—*Southern Med. J.*, xxv, no. 5, pp. 533–536. Birmingham, Ala., May 1932. [*Cf. R.A.E.*, B, xx, 174.]

de Buen (E.). **Studies relating to the Biology of** *Anopheles maculipennis* [in Spain] **with special Reference to the Dwellings of Man and Animals.**—*J. Trop. Med. Hyg.*, xxxv, no. 16, pp. 242–247, 3 charts. London, 15th August 1932. [Translation of *R.A.E.*, B, xx, 18.]

Davis (N. C.). **The Effect of various Temperatures in modifying the Extrinsic Incubation Period of the Yellow Fever Virus in** *Aëdes aegypti* [*argenteus*, Poir.].—*Amer. J. Hyg.*, xvi, no. 1, pp. 163–176, 1 graph, 2 pp. refs. Baltimore, Md., July 1932. [For summary see *R.A.E.*, B, xix, 213.]

Mathis (C.) & Durieux (C.). **Identité, à Dakar, de** *Spirochaeta duttoni* **var.** *crocidurae* **et du spirochète infectant dans la nature** *Ornithodorus erraticus*.—*Bull. Soc. Path. exot.*, xxv, no. 7, pp. 843–853. Paris, 1932. [Details of cross-immunity experiments, *cf. R.A.E.*, B, xx, 139.]

Ewing (H. E.). **A new Sucking Louse from the Chimpanzee** [*Pediculus* (*Paenipediculus*) *simiae* subgen. et sp. n.].—*Proc. Biol. Soc. Wash.*, xl, pp. 117–118. Washington, D.C., 30th July 1932.

O'Connor (B. A.). *Solenopotes capillatus*, **Enderlein, a Sucking Louse of Cattle hitherto unrecorded from Australia.**—*J. Dept. Agric. W. Aust.*, (2) ix, no. 2, pp. 300–302, 4 figs., 3 refs. Perth, W.A., June 1932.

Kerr (J. A.). **Studies on the Transmission of experimental Yellow Fever by** *Culex thalassius* **and** *Mansonia uniformis.*—*Ann. Trop. Med. Parasit.*, xxvi, no. 2, pp. 119–127, 12 refs. Liverpool, 14th July 1932.

Transmission experiments have been carried out in Nigeria with *Culex thalassius*, Theo., and *Mansonia* (*Mansonioides*) *uniformis*, Theo., two species that are additional to the seven West African mosquitos (other than *Aëdes argenteus*, Poir.) already shown experimentally to be vectors of yellow fever [*R.A.E.*, B, xvi, 235; xvii, 213; xviii, 147], and are abundant in parts of West Africa, where they readily enter houses and bite man with great frequency.

Transmission of yellow fever to *Macacus rhesus* by bites of *C. thalassius* was obtained only after an extrinsic incubation period of 27 days, indicating that this species is an inefficient vector in comparison with *A. argenteus*. Its density at certain places in a narrow zone along the West African coast may, however, compensate for its relative inefficiency as a vector and may make it of some importance in the epidemiology of yellow fever at these points. *M. uniformis* did not transmit yellow fever by biting after an extrinsic incubation period ranging up to 21 days, the longest period after which it could be induced to feed a second time. Conditions in the bodies of a few individuals of this mosquito seem to be deleterious to the virus, but 14 out of 17 were found to be capable of retaining it in amounts lethal to monkeys for at least 15–17 days. Some were able to retain the virus for 24 days. It was not found possible to keep these mosquitos alive long enough in captivity to demonstrate conclusively whether they might transmit yellow fever by biting, but the long extrinsic incubation period that appears to be essential would prevent the species from being an efficient vector.

Morris (K. R. S.). **The Infection of a Guinea-pig with** *Trypanosoma congolense* **and** *T. gambiense* **from the Bite of** *Glossina longipalpis.*—*Ann. Trop. Med. Parasit.*, xxvi, no. 2, pp. 129–138, 3 charts, 1 fig., 2 refs. Liverpool, 14th July 1932.

In the course of an ecological study of *Glossina longipalpis*, Wied., carried out at Takoradi in the Gold Coast during the first half of 1931, 20 per cent. of the flies examined in May and June showed mature *Trypanosoma congolense* infections and 4 per cent. *T. vivax* infections. Experiments were then undertaken in feeding wild infected flies on guineapigs in an attempt to infect the animals with these trypanosomes.

Out of a series of attempts to establish *T. congolense* in guineapigs, both by exposing the animal to bites of infected flies and also by injection of a suspension of dissected and teased-up probosces [*cf. R.A.E.*, B, xii, 85], the only success was obtained when *T. gambiense* was also present. In the original animal *T. gambiense* was the first to appear in the peripheral blood, and this proved to be the case in subinoculated animals. In the first and subsequent passages through guineapigs, *T. congolense* was predominant in the late stages of the infection and apparently was responsible for death, *T. gambiense* remaining in moderate numbers in the peripheral blood.

In subinoculated bush rats (*Cricetomys gambianus*) *T. gambiense* appeared in 3–4 days, increased immediately and killed the animal in 6–12 days. *T. congolense* appeared only in the last stage of infection when *T. gambiense* was swarming. In *Mus rattus* there was essentially the same course but the disease was prolonged. The infection increased in virulence towards both rats and guineapigs in successive passages by injection.

JAMES (S. P.), NICOL (W. D.) & SHUTE (P. G.). *Plasmodium ovale* **Stephens: Passage of the Parasite through Mosquitoes and successful Transmission by their Bites.**—*Ann. Trop. Med. Parasit.*, xxvi, no. 2, pp. 139–145, 2 charts, 3 refs. Liverpool, 14th July 1932.

Since its original discovery, *Plasmodium ovale* [*R.A.E.*, B, xi, 36] has been found in man in Nigeria and the Belgian Congo. In a study in England, an account of which is given, a strain of the parasite received from the Belgian Congo and inoculated into patients suffering from general paralysis was successfully passed through *Anopheles maculipennis*, Mg., and transmitted by the bite of this mosquito to man. It was found that *P. ovale* is definitely a distinct species, and that its morphological characters in the human and insect hosts (which are to be the subject of a subsequent paper) are characteristic and constant.

HICKS (E. P.). **A simple Apparatus for breeding Fleas.**—*Ann. Trop. Med. Parasit.*, xxvi, no. 2, pp. 147–148. Liverpool, 14th July 1932.

An apparatus devised for breeding *Tunga penetrans*, L., in Sierra Leone is described. Two glass containers are fitted with bored corks through which a glass tube is passed. One end of the tube is flush with the inner surface of the cork in one container, the other projecting into the interior of the second. A slip of damp blotting paper may be inserted between the cork and the side of the first container to raise the humidity if necessary. The corks should be covered with wax to prevent the escape of the fleas through some unnoticed crevice. A cylinder of brown paper, which is loose and can be slipped off, is made to fit over the apparatus from the base of the first container to the cork of the second. A culture of the larvae, with the material in which they are breeding, is placed in the first container, the apparatus is closed and the brown paper cover slipped over it. When the adults emerge, they make their way from the dark container through the tube into the light one. After sufficient adults have collected, the second container, together with its cork, is slipped off the tube, cotton wool plugs being fitted into the apertures left open. The fleas can be killed by blowing chloroform into the container by means of a capillary pipette. It was possible to observe by means of this apparatus that of a culture of *T. penetrans* bred from a number of eggs laid on the same day, the females emerged before the males, this being contrary to the sequence observed in some other insects, such as mosquitos.

DUKE (H. L.). **The Polymorphic Trypanosomes of Damba Island, Victoria Nyanza. I. Their Ability to infect Man.**—*Ann. Trop. Med. Parasit.*, xxvi, no. 2, pp. 191–206, 4 refs. Liverpool, 14th July 1932.

The following is the author's summary: Laboratory bred *Glossina palpalis*, R.-D., cyclically infected with three different strains of polymorphic trypanosomes recovered from the wild *G. palpalis* on Damba Island, Victoria Nyanza, have been fed upon four normal human beings, three being natives and one European. One native was in this way exposed to infection by all three strains, the other volunteers to two strains each. None of the volunteers became infected.

KUMM (H. W.). **Yellow Fever Transmission Experiments with South American Bats.**—*Ann. Trop. Med. Parasit.*, xxvi, no. 2, pp. 207–213, 7 refs. Liverpool, 14th July 1932.

A series of experiments have been carried out at Bahia, Brazil, to determine whether bats could serve as a reservoir of yellow fever virus. Two species, *Molossus obscurus* and *M. rufus*, were found in Bahia, and it was observed that *Aëdes argenteus*, Poir. (*aegypti*, auct.) fed readily on both. Attempts to transmit yellow fever virus to *M. rufus* and *Desmodus rotundus*, the common South American vampire bat, by infected *A. argenteus*, and later to re-obtain the virus from the bats by means of normal *A. argenteus* or by blood subinoculation were unsuccessful. Immediate mechanical transmission of yellow fever was obtained in two experiments by the bite of *D. rotundus*. Such transmission of yellow fever is probably of little significance in the epidemiology of the disease in man, but mechanical transmission of certain diseases of animals by the bites of vampire bats may be of considerable economic importance.

EVANS (A. C.). **Some Aspects of Chemical Changes during Insect Metamorphosis.**—*J. Exp. Biol.*, ix, no. 3, pp. 314–321, 5 figs., 14 refs. London, July 1932.

Detailed descriptions are given of the changes in carbohydrate content, fatty acid content and nitrogen distribution that take place during the metamorphosis of *Lucilia sericata*, Mg., from larva to adult.

SAUNDERS (G. F. T.) & MORRIS (K. R. S.). **The Distribution of Human Trypanosomiasis.**—*W. Afr. Med. J.*, v, no. 3, pp. 39–45, 1 pl., 1 map, 8 refs. Lagos, January 1932.

A sleeping-sickness survey was carried out in Eastern Ashanti and the Eastern Gonja District of the Gold Coast. The area comprises two types of country, orchard bush savannah, which prevails in the north, and the rain forest of Ashanti, which extends to the south. In the former, *Glossina palpalis*, R.-D., and *G. tachinoides*, Westw., are the predominant species of tsetse-fly and are confined strictly to the vicinity of rivers and streams. In the latter, *G. palpalis* and *G. longipalpis*, Wied., occur, but are more widely and uniformly distributed. In the savannah country, the majority of cases occurred along the river where there are most flies, and along the main road where there are most people, with a maximum of infection where road and river intersect. In the forest, the distribution of cases showed no relation to road or river. Infection was higher in permanent than in temporary fishing villages on the Volta, although the latter are more heavily infested with fly. This can be explained by the annual evacuation of the temporary camps and the consequent interruption of the man-fly-man infection. In the authors' experience in the Gold Coast, sleeping sickness only occurs where *G. palpalis* is present, but *G. longipalpis* has been found infected with *Trypanosoma gambiense*, *G. tachinoides* is a proved vector elsewhere [*R.A.E.*, B, xi, 118; xv, 37] and *G. morsitans*, Westw., and *G. morsitans submorsitans*, Newst., are possible carriers. *G. palpalis* shows a preference for man and domestic animals and tends to concentrate round village water holes, ferries and fords, where its opportunities for transmitting disease are increased. A fairly close correlation has been found between the density of *G. palpalis* and rainfall in the savannah country. An attempt is made to correlate man, fly and trypanosome by means of mathematical formulae, and the difficulties and possibilities attending the practical application of such formulae are discussed.

Chorley (J. K.). **Report of the Chief Entomologist for the Year ended 31st December 1931. Medical and Veterinary.**—*Rhodesia Agric. J.*, xxix, no. 7, pp. 524–538. Salisbury, July 1932.

Little change took place in the general position as regards *Glossina morsitans*, Westw., in Southern Rhodesia during 1931, and the total infested area now occupies roughly 22,000 sq. miles. Experience in Lomagundi has shown that a buffer area of 10 miles is too narrow, and the erection of a third fence in the Gatooma area, making a total zone of 20 miles wide free from game, was proposed [*cf. R.A.E.*, B, xviii, 217]. The operations carried out in various districts are reviewed. As a result of experiments with traps [xix, 179], it is considered that the present methods of trapping will not eliminate *G. morsitans* in Southern Rhodesia, for even in selected areas of fairly high density the numbers caught were quite insignificant compared with the total numbers of fly present.

Since the first severe outbreak during the wet season of 1918–19 of myiasis of animals caused by *Chrysomyia bezziana*, Villen., this fly has become a pest throughout the Colony, causing serious losses in most cattle-raising districts. Females were frequently observed feeding upon the blood and septic liquids exuding from cuts, bruises and other wounds in cattle. They were not seen at purulent wounds. Several batches of about 150 eggs are laid, usually at the edge of the wounds, and hatching occurs in 12–18 hours or more. The larvae feed on the blood and septic exudations around the wound and later invade the living tissue, the total feeding period occupying about 6–7 days. They pupate about ½ in. below the ground after an interval of 2–3 days. The pupal period varies from about 7 days in February to 27–35 in June and July. Cows and young stock were chiefly attacked. Over 60 per cent. of the wounds appeared to have resulted from heavy infestations by *Hyalomma aegyptium*, L. (bont-legged tick). Several cases of myiasis in sheep were due to *C. bezziana* and *Lucilia cuprina*, Wied.

Lewis (E. A.). **A Study of the Ticks in Kenya Colony. The Influence of Natural Conditions and other Factors on their Distribution and the Incidence of Tickborne Diseases. Part II. A Report on an Investigation into the Tick Problem in the Rift Valley (contd.), the Uasin Gishu and the Trans Nzoia Districts, Kenya Colony.**—*Bull. Dept. Agric. Kenya*, no. 6 of 1932, 33 pp., 1 fldg. map. Nairobi, 1932. Price 1*s*.

This paper, which is the second of a series on the incidence of ticks in Kenya Colony [*R.A.E.*, B, xx, 21], deals with further work carried out in the Rift Valley and with investigations in two other districts.

Observations on individual farms have shown the value of dipping as a measure of control. In the case of *Rhipicephalus appendiculatus*, Neum., it appears in general that temperature and humidity prevent the tick from propagating at the higher altitudes in Kenya. This species was found on cattle grazing at an altitude of 9,080 ft. in the Timboroa district and was not uncommon at 8,200 ft. in the mountainous areas of Uasin Gishu, but its presence in these places may be accounted for either by the moderating influence of forests or by the continuous movement of stock from the plains to the highlands. The tick may not thrive on the open country of these highlands, but may easily carry the infective organism of African coast fever. The inability to control and supervise thoroughly the movement of native stock is undoubtedly a factor in the distribution of ticks. Moreover, *R. appendiculatus* has been found on sheep, and transport oxen immune from African coast fever may not only carry uninfected ticks, but a small number of the latter may become infected during the reaction of the host. In districts where *Amblyomma variegatum*, F., and *R. appendiculatus* are common, it is suggested that infected farms may be freed from ticks by allowing native sheep and goats immune from heartwater and transport or work oxen immune from African coast fever (or even donkeys and mules) to graze in small paddocks on a rotation principle, regularly dipping and hand-dressing them to remove the ticks collected. It has been shown that active, unfed ticks do not usually migrate for more than about 70 ft. in their search for a host and that they usually restrict their movements to land that provides some shelter from the sun. It is therefore suggested that contamination of land free from ticks from adjoining infested land may be avoided by double fences 70 ft. apart or by removing the turf on the ground adjoining the fence for a width of 30–70 ft.

FAURE (L.). **Elevage et maladies des animaux domestiques en Tunisie.** —*Mém. Soc. Sci. nat. Maroc*, no. 30, 182 pp., 7 pls., 3 figs., 1 map. Rabat, 1932. Price *Fr.* 40.

The second part of this treatise deals with diseases and includes general accounts of those transmitted by Arthropods and of the pathological conditions caused by Arthropod parasites.

ROBERTS (R. A.). **Myiasis in Jack Rabbits,** *Lepus californicus texianus*. —*J. Parasit.*, xviii, no. 2, pp. 102–104, 3 refs. Urbana, Ill., December 1931. [Recd. August 1932.]

The author records cases from Texas in which larvae of *Cochliomyia macellaria*, F., and *Sarcophaga sulcata*, Ald., were removed from lesions in hares (*Lepus californicus texianus*) caused by previous infestation by *Cuterebra*. Larvae and eggs of *C. macellaria* and larvae of *S. plinthopyga*, Wied., were also obtained from gunshot wounds in these animals.

THOMAS (L. J.) & CAHN (A. R.). **A New Disease in Moose. I. Preliminary Report.**—*J. Parasit.*, xviii, no. 4, pp. 219–231, 2 figs., 2 pls., 10 refs. Urbana, Ill., June 1932.

The authors describe a disease of moose in northern Minnesota characterised by weakness, anaemia, paralysis, excessive blind activity and death. It occurs only during the late winter and early spring (usually between February and May) ; at this time many moose are infested with the tick, *Dermacentor albipictus*, Pack., and in some cases are almost devoid of hair as a result of severe infestation. Experiments are described in which the symptoms have been reproduced in guineapigs and rabbits infested with ticks taken from diseased moose, thus demonstrating that the disease is transmitted by the tick. A total of 75 per cent. of the experimental animals upon which adults of both sexes engorged for more than two days died, but animals that removed the ticks within 24 hours did not contract the disease. An organism has been isolated from female ticks engorged on an infected moose, which, on intravenous injection into guineapigs and rabbits, produced all the symptoms of the disease.

A brief summary of the life-history of the tick is given [*cf. R.A.E.*, B, i, 161]. In a piece of moose hide with a heavy tick infestation, the authors found engorged females ovipositing in the tangled hair about to be shed. If this be a normal method of procedure, it is a very efficient method of tick dissemination, for the host, wandering through the brushwood, will leave the eggs widely scattered over the country.

HEARLE (E.). **Warble Flies and their Control in Canada.**—*Pamph. Dept. Agric. Canada,* N.S. no. 147, 11 pp., 4 figs., 1 ref. Ottawa, May 1932.

An account is given of the bionomics and control of *Hypoderma lineatum*, Vill., and *H. bovis*, DeG., which occur in all parts of Canada where cattle are raised, and are estimated to cause annual losses ranging from 7 to 14 million dollars or more. Adults of the former usually appear on the wing during the first warm days of spring, and over a large part of Canada the period of adult activity is from April to June. The latter develops later and is on the wing from June to August.

CAMERON (A. E.). **Parasites of Horses.**—*Bull. Dept. Agric. Canada,* N.S. no. 152, 22 pp., 24 figs. Ottawa, 1932.

In the course of this paper on parasites of horses in Canada, brief accounts are given of the bionomics and control of the bot flies, *Gastrophilus haemorrhoidalis*, L., *G. nasalis*, L., and *G. intestinalis*, DeG., the lice, *Haematopinus asini*, L., *Trichodectes pilosus*, Giebel, and *T. equi*, L. (*parumpilosus*, Piaget), and the mites causing sarcoptic, psoroptic and chorioptic mange.

REBRASSIER (R. E.) & MARTIN (E. D.). *Syringophilus bi-pectinatus* **a Quill Mite of Poultry.**—*Science,* lxxvi, no. 1962, p. 128, 5 refs. New York, 5th August 1932.

In 1930 about 75 per cent. of 1,500 fowls in Ohio, although otherwise in good condition, were affected with a loss of feathers due to the mite, *Syringophilus bipectinatus*, Heller. Subsequently the mite was found in 5 widely separated flocks of fowls and also on turkeys and golden pheasants.

[MCHARDY (J. W.).] **Abridged Report by the Entomologist.**—*Ann. Med. Sanit. Rep. Tanganyika Terr. 1930,* pp. 44–51. Dar es Salaam, 1932.

Brief accounts are given of local mosquito surveys in Tanganyika Territory, and measures of control are recommended. *Anopheles gambiae*, Giles, is the important vector of malaria, though *A. funestus*, Giles, was also found. In two cases lists of the Culicines collected are also given. Other Anophelines observed included four not mentioned in a previous report [*R.A.E.*, B, xviii, 162], *viz.*, *Anopheles machardyi*, Edw. [xix, 63], *A. nili*, Theo., *A. pharoensis*, Theo., and *A. transvaalensis*, Carter.

Saunders (G.) & Morris (K. R. S.). **Suggestions for the Control of Human Trypanosomiasis.**—*W. Afr. Med. J.*, v, no. 4, pp. 62–64, 2 refs. Lagos, April 1932.

As there are several different species of *Glossina* with widely differing habits in the Gold Coast that are potential vectors of sleeping sickness [*R.A.E.*, B, xx 223], measures suggested for their control over a wide area will necessarily be found somewhat excessive in certain localities. The minimum distance to be cleared along the banks of streams should be 50 yds. on each side of village water-holes, and the work of clearing should involve the complete removal of all vegetation, as this procedure is not only more effective but tends to inhibit regrowth, owing to the drying of the ground [xix, 151]. The planting of cleared areas with low-growing crops should always be undertaken. Ground-nuts are the most suitable, as they can be grown on the same land for a number of years. Cereals are unsuitable, as they are inclined to harbour small game that attract fly. At ferries and at all big river-road crossings the clearing should extend for a quarter of a mile on either side.

Investigations indicate the possibility of greatly increasing the effectiveness of riverside clearings by maintaining a barrier of dense low growth at each end between the fly-belt and the clearing. It is also possible that if a fly-trap were used, large trees might be left standing to provide shade for the people and to prevent undue drying up of the water. These methods would be justified at such places as large towns. In clearings round towns, drainage is of value in checking the regrowth of the typical moisture-loving flora of fly-belts and may altogether inhibit its re-establishment.

Morris (K. R. S.). **Trypanosomes of Game in the Gold Coast.**—*W. Afr. Med. J.*, v, no. 4, pp. 65–67, 3 refs. Lagos, April 1932.

A comparison of the results obtained from the examination of trypanosome infection in a total of 42 game animals in the Northern Territories in 1929, when clearing on the eastern cattle route [*R.A.E.*, B, xix, 151] had scarcely begun to affect the cattle-fly-game connection, and in 1930, when the break in this connection was complete, suggests that in this area *Trypanosoma tragelaphi* is a normal parasite of game animals and that the trypanosomes pathogenic to cattle occur in game only when introduced by *Glossina* from cattle. Failing this source of infection, they disappear. *Glossina tachinoides*, Westw., is certainly a carrier of the pathogenic trypanosomes, and *G. palpalis*, R.-D., may also be involved, but as no infection was found in game in open country where *G. morsitans submorsitans*, Newst., occurs, the latter is considered to take no part in transmission.

Simić (T.). **Présence à Skoplje d'une variété de** *Phlebotomus perniciosus*.—*Ann. Paras. hum. comp.*, x, no. 5, pp. 431–434, 3 figs., 2 refs. Paris, 1st September 1932.

Sandflies are abundant in southern Serbia; they appear in May and are still to be seen at the end of October. Brief notes are given on the species that have been found by the author, *viz.*, *Phlebotomus papatasii*, Scop., *P. chinensis*, Newst., *P. major*, Annan., *P. minutus*, Rond., *P. perniciosus*, Newst., *P. perniciosus* var. *tobbi*, Adl., Thdr. & Lourie, and *P. perniciosus* var. *nitzulescui*, n., which is described from 3 males [*cf. R.A.E.*, B, xix, 159, 172, etc.]. *P. major* is rare in the plain, but appears to be much more prevalent in the mountainous regions, where other species are not found. *P. papatasii* is much the most common in houses ; of 2,647 sandflies taken in bedrooms, all belonged to this species except 5 *P. perniciosus* var. *tobbi* and 17 *P. chinensis*.

THEODOR (O.). **Ueber eine neue Methode zur Klassifizierung von Phlebotomen und ihre Bedeutung für das Studium der durch Phlebotomen übertragenen Krankheiten.** [A new Method of Classification of *Phlebotomus* and its Importance for the Study of Diseases carried by them.]—*Arch. zool.*, xvi, no. 3–4, pp. 1340–1349, 4 refs. Torino, 1932.

Some of the literature on the method of classification and specific identification of females of *Phlebotomus* by the characters of the pharynx, buccal cavity and spermathecae [*R.A.E.*, B, xiv, 96 ; xvii, 30, etc.] is reviewed.

ANDRÉ (M.). **De l'immunisation chez l'espèce humaine contre les attaques du** *Leptus autumnalis* **Shaw.**—*Arch. zool.*, xvi, no. 3–4, pp. 1350–1354, 11 refs. Torino, 1932.

The author concludes from his own observations and those of others over a number of years that certain persons are immune from attack by *Trombicula* (*Leptus*) *autumnalis*, Shaw, or if attacked show no ill-effects. It is uncertain whether this immunity is hereditary, but it is known that individuals born, or living for some time, in an infested neighbourhood are little troubled by the mite, while visitors to the locality are at once attacked. That immunity can be acquired is shown in the case of the author himself who, during his researches in France in 1927–28, was seriously inconvenienced by the mite, whereas in 1929, although equally exposed, he was practically free from attack and subsequent irritation.

ANDRÉ (M.). **Nouvelles observations sur les** *Thrombicula* **(Acariens).**—*Arch. zool.*, xvi, no. 3–4, pp. 1355–1362, 3 figs., 1 ref. Torino, 1932.

The author found some slight morphological differences in nymphs bred from larvae of *Trombicula* (*Leptus*) *autumnalis*, Shaw, found on a bat in northern France from those he had previously studied. From this he concludes that the term " *Leptus autumnalis* " is a collective name grouping larvae of a series of closely allied species. The differences are described, as are also the nymph and adult of a female of *Trombicula formicarum*, Berl. [*cf. R.A.E.*, B, xvi, 47 ; xviii, 126].

VOGEL (R.). **Zur Verbreitung von** *Argas persicus* **Oken und** *Argas reflexus* **Latr.** [On the Distribution of *A. persicus* and *A. reflexus*.]—*Zbl. Bakt.*, (I, Orig.) cxxv, no. 1–2, pp. 142–143. Jena, 6th July 1932.

Argas persicus, Oken, has been received from the neighbourhood of Smyrna, making an addition to the author's previous records of ticks from Asia Minor [*R.A.E.*, B, xv, 157]. *A. reflexus*, F. (*columbae*, Herm.) apparently occurs in all old dovecotes in South Germany. At Stuttgart all stages except the egg were found, and mating was observed. *Cimex lectularius*, L., was also found in dovecotes.

Jaarverslag over de jaren 1930 en 1931 van de Malaria-Commissie uit den Gezondheidraad. [Report for 1930 and 1931 of the Malaria Commission of the Health Council of Holland.]—*Versl. Meded. Volksgezondh.*, July 1932, reprint 27 pp. [Amsterdam, 1932.]

Regular work against the larvae [of *Anopheles maculipennis*, Mg.] was again continued at Alkmaar, Amsterdam, and Medemblik [*cf.* *R.A.E.*, B, xviii, 253]. At Alkmaar all waters within 1·5 km. [1,630 yds.] from the centre of the town were oiled 5–6 times, but a great reduction in the amount of oil used was obtained by applying it for a distance of 5 steps and then closing the delivery tap for 10 steps, reliance being placed on the film spreading over the intervening distance. It is estimated that over 2¾ million adult mosquitos were destroyed at Amsterdam. At Medemblik early in July 1930 the area treated covered a distance of 2 km. [1·24 mile] from the protected centre as in 1929 [*loc. cit.*], but as 15 new cases of malaria occurred on 8th July, the previous distance of 3 km. [1·86 mile] was restored, and Paris green was used at 2 per cent. strength instead of 1 per cent. Work on these lines was done in 1931 also. In 1931 two pigsties were built, one at 3 km. and the other at 5 km. [about 3 miles] from the dyke of the area reclaimed from the Zuyder Zee. Catches of Anophelines were made daily from early July to mid-September, and an average of 12·9 mosquitos were taken in the first sty and 6·6 in the second, the respective percentages of males being 13 and 22. This proves that they actually fly these distances. The anti-larval measures carried out at Medemblik from 1926 onwards have not prevented the recurrence of malaria (9 cases in 1930 and 12 in 1931), and as it is known that *A. maculipennis* flies for some miles, such measures are not considered of much value in reclaimed areas in Holland.

OTTOLENGHI (D.) & BROTZU (G.). **Intorno all eventuale azione dei pasti eterologhi sullo sviluppo e la sopravvivenza del parassita malarico nell' anofele. II.** [On the possible Effect of heterogeneous Meals on the Development and Survival of the Malarial Parasite in *Anopheles*.]—*Boll. Soc. ital. Biol. sper.*, vi, no. 11, pp. 1087–1089. Naples, December 1931.

Continuing previous experiments [*R.A.E.*, B, xvii, 177] with *Anopheles maculipennis*, Mg., it was sought to ascertain whether heterogeneous meals can prove unfavourable to the life of the sporozoites dispersed in the body of the mosquito after the rupture of the oöcysts. It was found that a reduction in the percentage of mosquitos infected with sporozoites of either benign or malignant tertian [*Plasmodium vivax* and *P. falciparum*] occurred among individuals fed 10–15 times on man or various animals. It could not be ascertained whether this was due to elimination of the sporozoites in feeding or to a higher mortality among the infected individuals. Another experiment, however, indicated that the mortality of infected mosquitos was not higher than that of uninfected ones during the progress of the sexual development of the parasite in them.

ARA (F.) & MARENGO (U.). **Sull'importanza della mosca nella diffusione della febbre tifoide. Nota I.** [On the Importance of the House-fly in the Spread of Typhoid Fever. Note I.]—*Boll. Soc. ital. Biol. sper.*, vii, no. 2, pp. 150–154, 6 refs. Naples, February 1932.

In experiments in Italy, cultures made from flies (*Musca domestica*, L.) that had been kept under a glass jar and fed on faeces of typhoid patients showed that 44·4 per cent. of them had acquired the infection. Flies captured in the rooms of typhoid patients also proved to be infected, though the percentage was not determined. To ascertain the duration of the infection, flies were released in a small room in which they had access to faeces. These were removed after 12 hours, and the flies were then captured at intervals. After the fourth day the typhoid bacillus could no longer be found on the body, wings, or legs, but it was found in the alimentary tract up to the sixth day.

TATE (P.) & VINCENT (M.). **Influence of Light on the Gorging of** *Culex pipiens* **L.**—*Nature*, cxxx, no. 3279, pp. 366–367, 3 refs. London, 3rd September 1932.

Hitherto great difficulty has been experienced in Britain in inducing adults of *Culex pipiens*, L., to engorge, but during the breeding of this species for work on mosquito infection in avian malaria, it was noticed that light appeared to be an important factor. Experiments undertaken to confirm this showed that the mosquitos will engorge readily on canaries when placed in the dark after prolonged exposure to light, but if kept continuously in the dark they rarely feed. By utilising this method to obtain large numbers of engorged females and by feeding the larvae on boiled bakers' yeast, *C. pipiens* has been bred successfully under laboratory conditions. About 20 per cent. of the egg rafts are fertile, and the mortality from egg to adult is not more than 10 per cent.

MARSHALL (J. F.) & STALEY (J.). **Influence of Light on the Gorging of** *Culex pipiens* **L.**—*Nature*, cxxx, no. 3283, pp. 506–507, 2 refs. London, 1st October 1932.

With reference to the biting habits of *Culex pipiens*, L., in Britain [see preceding paper], it is pointed out that in the course of a long series of experiments carried out in 1931, females of *Anopheles*, *Theobaldia* and *Aëdes* fed readily in daylight on human blood, whereas those of *C. pipiens* were only induced to feed on 7 occasions.

ADLER (S.) & THEODOR (O.). **Vectors of Mediterranean Kala Azar.**—*Nature*, cxxx, no. 3283, p. 507, 1 ref. London, 1st October 1932.

Phlebotomus perniciosus, Newst., appears to be an important vector of Mediterranean kala-azar [*R.A.E.*, B, xix, 217], but it has not been found in Macedonia, Syria or Greece. In the neighbourhood of Argos, where infantile kala-azar is prevalent, and in Athens, where both infantile and canine kala-azar occur, *P. major*, Ann., was found to be common. Owing to its nocturnal habits and extreme photophobia after feeding, this species has been previously overlooked in Greece.

In tests to compare *P. major* and *P. perniciosus* as hosts of *Leishmania infantum*, wild individuals of both species were allowed to feed on a dog naturally infected with kala-azar. The behaviour of the flagellates in both species was identical ; 25 out of 31 individuals of *P. major* became infected but only 33 out of 119 of *P. perniciosus*. It therefore appears that the former is a better carrier of Mediterranean kala-azar than the latter, assuming the identity of canine and infantile kala-azar.

WLADIMIROW (M.) & SMIRNOV (E.). **Experimente an Wasserinsekten, die sich von Culicidenlarven ernähren.** [Experiments with aquatic Insects that feed on Culicid Larvae.]—*Zool. Anz.*, xcix, no. 7–8, pp. 192–206, 8 figs., 2 refs. Leipzig, 15th July 1932.

Investigating further the question of aquatic insect enemies of mosquito larvae [*R.A.E.*, B, xix, 148], the authors carried out experiments in the laboratory with water-bugs and Dytiscids found near Moscow. Of the water-bugs a species of *Notonecta* was found to be the most active in the destruction of the larvae, eating up to 25 a day, and of the Dytiscids *Acilius sulcatus*, L., which devoured a maximum of 24. In spite of its size *Dytiscus* (*Macrodytes*) *marginalis*, L., which normally attacks young fish, consumed fewer larvae than did smaller insects. Except in the case of *Corixa* (*Macrocorixa*) *geoffroyi*, Leach, which ate equal numbers of larvae of *Culex* and *Anopheles*, all the species tested preferred the former, the degree of preference varying until, in the case of *Agabus sturmi*, Gyll., nearly three times as many larvae of *Culex* were destroyed.

HOBSON (R. P.). **Studies on the Nutrition of Blow-fly Larvae. III. The Liquefaction of Muscle. IV. The normal Rôle of Micro-organisms in larval Growth.**—*J. Exp. Biol.*, ix, no. 4, pp. 359–365, 14 refs. ; pp. 366–377, 2 graphs, 22 refs. London, October 1932.

The following is almost entirely taken from the author's summaries : Investigation of the feeding of larvae of *Lucilia sericata*, Mg., on meat suggested that the chief factors involved are mechanical maceration and the alkaline reaction which results in the first place from bacterial action. Larvae suck the fluid serum from acid muscle ; they ingest semi-liquid food only when the reaction is alkaline or the free liquid has been removed. Pre-digestion of the muscle substance is apparently not essential, as the crop contents often consist of insoluble protein. The proteolytic enzymes in the larval excreta, which include a collagenase, probably serve to digest the structural parts of muscle tissue. With regard to myiasis, larvae of *Lucilia* feed only on dead tissue according to Baer [*R.A.E.*, B, xx, 125] ; his observations refer to maggots used therapeutically in the treatment of osteomyelitis, large numbers being placed in open wounds. Since the author's experiments have shown that larvae feed readily on sterile muscle, products of bacterial action are not essential as attractants.

Larvae fail to grow at the usual rate when reared aseptically on sterile unheated muscle (guineapig). Infection with *Bacillus coli*, a non-liquefying organism which does not form ammonia, restores normal growth. Adding yeast extract to muscle produces the same effect on larval growth as infection with bacteria. It is therefore concluded that muscle is deficient in a growth-promoting factor that is normally supplied by the natural flora ; also that bacterial action is not essential for the liquefaction of the muscle. From preliminary experiments the growth factor does not appear to be identical with vitamin B_1 or B_2. Yeast extract that has been autoclaved at an alkaline reaction retains most of its activity and is not less potent than ox-liver extract. When larvae are reared aseptically on muscle, they feed at first on the serum owing to the persistence of the acid reaction. This, however, does not explain their slow development, since sterile larvae grow well on beef juice.

McCulloch (R. N.). **Jetting for the Reduction of Sheep Blowfly Attack.**—*Agric. Gaz. N.S.W.*, xliii, pt. 8, pp. 565–573, 3 graphs. Sydney, 1st August 1932.

The following is taken from the author's summary of the results of preliminary and field tests with a number of new jetting mixtures for reducing blow-fly attack on sheep, an account of which is given. Insoluble calcium arsenite in suspension in water seemed to give greater protection from attack than sodium arsenite solution or the arsenical sheep dip commonly employed. Paris green was only used in one experiment, but seemed to compare well with calcium arsenite. Soap or dilute caustic soda added to the mixture as a wetting agent reduces the danger of untreated patches occurring in the jetted area. The addition of kaolin to sodium arsenite solution does not increase its efficiency. Solutions of sodium fluosilicate gave less protection than arsenicals. Melaleuca oil, applied as a preventive in an emulsion containing 1·25 per cent. oil, was somewhat less effective than the arsenicals in reducing the ultimate degree of infestation. None of these mixtures was harmful, even when used on sheep already attacked. Infestation on sheep jetted with arsenicals did not spread to nearly so great an extent as on untreated sheep.

Sundar Rao (S.) & Iyengar (M. O. T.). **Experimental Infection of some Indian Mosquitoes with** *Wuchereria* (*Filaria*) *bancrofti.*—*Ind. J. Med. Res.*, xx, no. 1, pp. 25–34, 4 refs. Calcutta, July 1932.

In view of the fact that little work had been done on the susceptibility of Indian mosquitos to infection with *Filaria* (*Wuchereria*) *bancrofti*, the authors carried out experiments with 16 species from Lower Bengal during August 1930 and August–September 1931. The mosquitos were given an opportunity to feed on infected persons between 11 p.m. and midnight, and the ones that engorged were placed in cages with raisins and wet cotton and dissected on different days following the infecting feed. No infections were obtained with *Armigeres obturbans*, Wlk., *Aëdes vittatus*, Big., and *Mansonia* (*Mansonioides*) *annulifera*, Theo., but with the last species only 6 observations were made. Only a few individuals of *Aëdes argenteus*, Poir. (*aegypti*, auct.) became infected, and in these the parasites failed to develop beyond the very early stages. Infection was observed on the fourth day in one specimen of *Culex vishnui*, Theo., out of four examined. Some larvae reached maturity in *Anopheles hyrcanus* var. *nigerrimus*, Giles, and *A. barbirostris*, Wulp, but the development of a large proportion was suppressed. In *A. subpictus*, Grassi, *A. pseudojamesi*, Str. & Chd., and *A. varuna*, Iyen., few larvae were found, but they completed their development normally. There was no marked difference in the susceptibility of the fresh and salt water races of *A. subpictus*. *Culex fatigans*, Wied., *Anopheles pallidus*, Theo., *A. philippinensis*, Ludl., *A. fuliginosus*, Giles, *A. stephensi*, List., and *A. ludlowi* var. *sundaica*, Rodenw., were found to be efficient intermediate hosts for the parasite.

Only a few observations were made on *A. philippinensis*, but in the other species a fair number of larvae completed their development, taking 11 days in the case of the first two species and 10 days in the case of the last three. Natural infections were seen in females of *A. ludlowi*, *A. philippinensis* and *C. fatigans* caught in dwellings.

SINTON (J. A.). **Notes on some Indian Species of the Genus *Phlebotomus*. Part xxx. Diagnostic Table for the Females of the Species recorded from India.**—*Ind. J. Med. Res.*, xx, no. 1, pp. 55–74, 3 pls., 10 refs. Calcutta, July 1932.

The 27 species and 6 varieties of *Phlebotomus* that occur in India are divided into five groups, two belonging to the erect haired division, two to the recumbent haired, and one, which comprises only *P. squamipleuris*, Newst., being intermediate. A key is given to the females, excluding those of *P. maynei*, Sinton, and *P. eleanorae*, Sinton, which are not known. An explanation of the terms used in the key, and notes on methods of collecting, storing and mounting specimens and on the distribution of the Indian species are appended.

BUXTON (P. A.). **The Climate in which the Rat-flea Lives.**—*Ind. J. Med. Res.*, xx, no. 1, pp. 281–297, 4 figs., 23 refs. Calcutta, July 1932.

Although there are grounds for relating epidemics of plague and the numbers of fleas, particularly *Xenopsylla cheopis*, Roths., to climatic factors, to the effects of which the larvae of the flea are more susceptible than the adults, ordinary meteorological data are used in investigations in spite of the fact that there is probably little relation between the climate in a rat's nest and that registered in the standard Stevenson's screen.

The following is taken from the author's summary: A number of records of temperature and humidity were collected in Palestine at the hot, dry time of the year (June–July 1931), from various places in which rats and fleas lived. Methods appropriate for this type of investigation are described, and the different scales on which humidity may be measured are discussed. Thermohygrographs were exposed in stables, barns, etc., and in addition observations were made from time to time (but not with recording instruments) on the temperature and humidity in rat-holes and among heaps of cereals.

The temperature in the small environments is frequently higher than that in a meteorological screen, presumably owing to the fact that any building (and also the surface of the ground) absorbs radiant heat from the sun. In the rat-holes, etc., the temperature is also doubtless very stable. The conditions of humidity were found to vary greatly in different places. In a well ventilated office the absolute humidity was the same as in the screen. The saturation deficiency and the relative humidity in these circumstances are dependent on the temperature. However, in places where evaporation is taking place, the absolute humidity is higher than it is outside. This was shown to be so in a stable, a cellar and a number of rat-holes. In such situations, inasmuch as the temperature and the absolute humidity are both different from those in the screen, it is impossible to generalise about the saturation deficiency: in the majority of these places it was less than in the screen. These situations are therefore on the whole more favourable to flea-breeding than would be supposed from a study of the ordinary meteorological data.

It is suggested that, if more were known of the precise relation between climate and fleas at various stages, and if full use were made of solar radiation, it should be possible to construct buildings within which a climate unfavourable to fleas could be maintained and cereals, unginned cotton, etc., rendered free from these pests.

Korke (V. T.). **Observations on Filariasis in some Areas in British India. Part viii.**—*Ind. J. Med. Res.*, xx, no. 1, pp. 335–339, 14 refs. Calcutta, July 1932.

An investigation into filariasis in the Punjab was undertaken during October and November 1931, and examination of the blood of 1,000 persons gave negative results. In Bihar and Orissa it has been shown that the incidence of infection with *Filaria bancrofti* varies with the nature of the terrain, being highest in the sea-coast plain, high in the Gangetic plain (0–250 ft.) and lowest in the submontane arable areas [*R.A.E.*, B, xviii, 267]. Rice is the staple crop, and the areas where it is cultivated appear to be endemic centres. In both regions *Culex fatigans*, Wied., is prevalent, but the general level of the Punjab, excluding the Himalayan division, is between 1,000–1,500 ft. above sea level, and conditions are such that the staple crop is wheat. These observations suggest that there may be some correlation between low altitude with associated rice cultivation and the occurrence of endemic filariasis.

Gater (B. A. R.). **Entomological Investigations in Relation to Tropical Typhus in Malaya.**—*Trans. 8th Cong. Far East. Ass. Trop. Med. 1930*, pp. 132–143, 3 graphs, 7 refs. Bangkok, 1932.

A summary is given of the zoological investigations on tropical or scrub typhus that have been carried out in Malaya during recent years, much of the information having already been noticed [*R.A.E.*, B, xviii, 14; xix, 97; xx, 179]. In describing *Trombicula deliensis* [xi, 134], Walch separated it from *T. akamushi*, Brumpt, chiefly on the smaller number of dorsal setae. In Malaya the author has seen examples with dorsal setae varying in number from 22 to 40, and though in general they could be separated into two groups, with averages of 28 and 34 setae respectively, the two forms appeared to merge into one another. On the other hand, *T. akamushi* was the commonest mite on man but was rare on rats and was only taken on one other animal, whereas *T. deliensis* was scarce on man but common on rats and other animals. Owing to this host preference, the author considers that they should be maintained as distinct species until further material from Malaya and Sumatra has been examined.

Bonne (W. M.). **Filariasis.**—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 18, pp. 1192–1195. Batavia, 30th August 1932.

Of 1,360 persons examined at Soekaboemi, Java, 3 harboured *Filaria* (*Microfilaria*) *bancrofti* and 7 *F.* (*M.*) *malayi*. Attempts to infect *Culex fatigans*, Wied., with *F. malayi* failed, thus confirming the negative results obtained in Sumatra [*R.A.E.*, B, xvi, 41].

Venhuis (W. G.). **Een nieuwe anopheline,** *Anopheles meraukensis.*—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 16, pp. 1040–1042, 1 pl. Batavia, 2nd August 1932. (With a Summary in English.)

Venhuis (W. G.). **De mannelijke imago van** *Anopheles meraukensis* **Venhuis.** [The male Adult of *A. meraukensis.*]—*T.c.*, p. 1043. (With a Summary in English.)

Soesilo (R.) & Schoonheyt (L. J. A.). *Anopheles meraukensis* **Venhuis, 1932.**—*T.c.*, p. 1044.

Descriptions are given of the larva and adults of both sexes of *Anopheles meraukensis*, sp. n., from Netherlands New Guinea, where it was found breeding in a rice-field and in shallow puddles in a marsh. The female has been taken indoors. The third paper discusses the great similarity of *A. meraukensis* to *A. amictus*, Edw., but considers it to be distinct on account of marked differences in the larvae.

King (W. V.). **Three Philippine** *Anopheles* **of the** *funestus-minimus* **Subgroup.**—*Philipp. J. Sci.*, xlviii, no. 4, pp. 485–523, 2 pls., 21 refs. Manila, 1932.

The following is taken from the author's summary :—The *funestus-minimus* subgroup of *Anopheles* is represented in the Philippines by three species, one of which has previously been confused with the other two. This species appears to agree with the type specimens of *A.* (*Myzomyia*) *mangyanus*, Banks, described in 1906 and *A.* (*M.*) *febrifer*, Banks, in 1914, both of which have always been regarded as synonyms of *A. minimus*, Theo. The name *A. mangyanus* is therefore provisionally assigned to it. Comparative descriptions of the three species are given, together with new descriptive notes on the typical forms of *A. funestus*, Giles, *A. minimus* and *A. aconitus*, Dön.

The Philippine form of *A. minimus* differs in certain respects from specimens of the typical form from China, and its separation as a variety, under the name *A. minimus* var. *flavirostris*, Ludl. [*R.A.E.*, B, ii, 70] seems to be justified. This is the best known of the three local species, and during recent years has come to be considered the only Philippine Anopheline of serious importance in the transmission of malaria. Nearly all the evidence, however, has been obtained without distinguishing between the three forms, all of which should therefore be suspected. Moreover, the probability that most of the experimental results obtained with *A. febrifer* [iii, 65] are attributable to *A. mangyanus*, as here defined, rather than to *A. minimus* var. *flavirostris*, implies that this species is readily infected with malaria parasites. In addition *A. mangyanus* is found in situations with which malaria is usually associated in the Philippines.

The third species, *A. filipinae*, Mnlg. [xix, 5, 245], appears in general to be the least plentiful of the three in central and probably in southern Luzon. Although it has not previously been suspected of being a malaria vector, recent observations in one of the northern provinces have shown it to be abundant in places where the disease is unusually prevalent.

These species breed in small streams and all occur on Luzon Island. Although they show preferences for different types of breeding-places, they are frequently more or less closely associated. In view of their morphological differences under these conditions, it is evident that interbreeding does not normally occur, and they must, therefore, be regarded as distinct species rather than as varieties of a single one.

Certain differences have been found in the male genitalia of these three species, and the typical *A. funestus* and *A. minimus*. The occurrence of unusually distinctive characters in the case of *A. funestus* is further evidence of its specific differentiation from the Oriental species.

In mountain streams *A. mangyanus* was found in association with *A. insulaeflorum*, Swellgr., a species not previously recorded from the Philippines.

West (A. P.) & Russell (P. F.). **Paris Green partially adsorbed on Charcoal as a Larvicide for** *Anopheles* **Mosquitoes. Larvicide Studies, II.**—*Philipp. J. Sci.*, xlviii, no. 4, pp. 545–561, 2 pls., 13 refs. Manila, 1932.

This paper gives in tables the results of numerous laboratory experiments in which Paris green and other substances partly adsorbed by charcoal were tested against Anopheline larvae. In this case, the charcoal is not considered as a diluent for the Paris green [*cf. R.A.E.*, B, xx, 215] but as a vehicle by means of which the latter is carried into the gut of the larva. In the 1 per cent. mixture [*loc. cit.*] approximately one particle in 100 is toxic, whereas in the case of the adsorbed Paris green each particle is charged with poison. The larvae show no aversion from the charcoal, which they ingested without difficulty. The charcoal was powdered sufficiently finely to pass through a 50-mesh sieve. The adsorption of Paris green (and other substances) was carried out in the following manner: 5 gm. of charcoal was placed in a beaker with the amount of Paris green necessary to make the concentration desired. About 60 cc. water was added, and the mixture stirred thoroughly and heated to a temperature of about 90°C. It was then transferred to an evaporating dish and evaporated to dryness. The residue was scraped from the dish and powdered. A sample of larvicidal charcoal prepared in this way and consisting of 1 part Paris green and 99 parts charcoal is regarded as containing 1 per cent. Paris green. As Paris green alone is rather insoluble in water, only part of it is adsorbed during this treatment, the rest being simply mixed with the charcoal. The technique of the experiments is described. The pans used had a surface area of 532 sq. cm. and a depth of 5 cm. In the tests, Paris green was always used in combination with some other substance. When charcoal was treated with Paris green and oxalic acid in various concentrations, the best results were obtained with 3 per cent. Paris green and 1 per cent. oxalic acid, using 0·1 gm. of the larvicide. When 0·01 gm. of the larvicide was used and the percentage of the Paris green was 35, the lethal effects of the combination in 24 hours were no greater than when the percentage was 7, though deaths occur earlier with the stronger combinations. When lime was used instead of oxalic acid, the larvicidal effect was slightly enhanced, and very low concentrations were found to be as effective as the standard 1 per cent. mixture of Paris green and diluent. A concentration of 0·1 per cent. Paris green with 0·5 per cent. lime killed all the larvae in 24 hours. According to usual field practice 0·665 gm. of the 1 per cent. mixture would be needed for a surface of 532 sq. cm., whereas in this experiment only 0·1 gm. of the 0·1 per cent. larvicidal adsorbed charcoal was used (0·0001 gm. Paris green). Plain lime and charcoal treated with lime had little effect on the larvae. Further tests indicated that borax was not so effective as lime in combination with Paris green. Tests were also made of a combination of Paris green and arsenic trioxide, together with either lime or borax. Concentrations of Paris green as low as 0·05 per cent. with an equal amount of arsenic trioxide and 0·1 per cent. borax killed 94 and 88 per cent. of the larvae in 24 hours.

Russell (P. F.) & West (A. P.). **Some Studies in the Larvicidal Effects of Arsenicals other than Paris Green against Anopheles Larvae. Larvicidal Studies, III.**—*Philipp. J. Sci.*, xlix, no. 1, pp. 97–103, 4 refs. Manila, 1932.

Tests made with arsenic trioxide, either mixed with or partially adsorbed by charcoal [see preceding paper] to determine whether it could be substituted as a mosquito larvicide for the more expensive Paris green, showed that it was much less effective. A mortality of 100 per cent. of the larvae in 24 hours was not obtained until the concentration of the adsorbed trioxide had reached 8·5 per cent., and at 10 per cent. the larvae were not always killed. Combinations of arsenic trioxide with lime, borax or sodium carbonate adsorbed by charcoal were not so effective as similar combinations using Paris green. These results suggest that the copper in the Paris green has an influence on the larvicidal properties of this material. Tests were also made with miscellaneous arsenical preparations adsorbed by charcoal in various combinations and concentrations, but none gave results comparable to those obtained with Paris green except zinc arsenite.

Lambert (S. M.). **Health Survey of Rennell and Bellona Islands.**—Fol. 14 pp., 9 refs. Suva, 1932.

In the course of investigations on Rennell and Bellona Islands, no malaria was observed and no Anophelines were caught, although the islands are in the malaria belt. Possibly their isolation has protected them. No night-biting mosquitos were collected, but *Aëdes scutellaris*, Wlk. (*variegatus*, Dolesch.) and *A. albilabris*, Edw., were taken on Bellona, and these two mosquitos, together with *A. scutellaris* var. *hebrideus*, Edw., and *Culex* (*Lophoceratomyia*) *hilli* var. *buxtoni*, Edw., on Rennell.

Paine (R. W.). **Coconut Committee. Entomological Report.**—*Ann. Bull. Div. Reps. Dept. Agric. Fiji 1931*, pp. 1–6. Suva, 1932.

A colony of *Megarhinus splendens*, Wied., the larvae of which attack those of certain other mosquitos in tree-hole water, barrels, etc., was introduced from Java into Fiji at the end of February. In Fiji it feeds principally on *Aëdes scutellaris*, Wlk. (*variegatus*, Dolesch.), the vector of filariasis. In one small area of swamp land containing trees (*Inocarpus edulis*) it became well established, causing a reduction of quite 50 per cent. in the numbers of *Aëdes*, but in other localities with a less concentrated supply of suitable breeding-places it has not been so successful. As oviposition does not occur on water on the ground, this mosquito cannot be expected to exercise any appreciable degree of control over *Culex* spp. or *A. vexans*, Mg.

Riley (W. A.) & Chen (Hsin Tao). **Notes on Fleas of Canton, China, Rats.**—*Lingnan Sci. J.*, xi, no. 3, pp. 445–448, 7 refs. Canton, 22nd July 1932.

During October-December 1931, 35 rats were collected in Canton and examined for ectoparasites. These comprised one individual of

Polyplax spinulosa, Burm., 20 mites, of which 7 were *Echinolaelaps echidninus*, Berl., and the others undetermined species of *Dermanyssus*, and 52 individuals of *Xenopsylla cheopis*, Roths., 44 of *Leptopsylla segnis*, Schönh. (*musculi*, Dug.), and 15 belonging to the genus *Ceratophyllus*.

RILEY (W. A.). **Anopheline Mosquitoes from the Island of Hainan, China.**—*Lingnan Sci. J.*, xi, no. 3, p. 468. Canton, 22nd July 1932.

The following Anophelines were collected between 16th April and 14th May (dry season) from three representative sections of the Island of Hainan, where malaria is very prevalent : *Anopheles hyrcanus* var. *sinensis*, Wied., *A. hyrcanus* var. *nigerrimus*, Giles, *A. barbirostris*, Wulp, *A. minimus*, Theo., *A. jeyporiensis*, James, *A. vagus*, Dön., *A. jamesi*, Theo., *A. maculipalpis*, Giles, and *A. tessellatus*, Theo.

HALE (C.). **Anopheles Mosquito Control.**—*20th Ann. Rep. Med. Dept. United Fruit Co. 1931*, pp. 98–107. Boston, Mass. [1932.]

The author discusses factors influencing the production of Anophelines on the properties of the United Fruit Company, which are situated in tropical climates in Central America. The malaria control measures consist chiefly in the reduction of mosquito-breeding and the treatment of gametocyte carriers. Until recently Paris green was applied by hand, as the use of the coarse diluents available, such as sawdust, sand, etc., clogged the mechanical dusters. It has now been found that soapstone and limestone dusts, and slaked lime can be obtained at prices that permit their use, and their uniform fineness ensures a perfect blending with the Paris green and facilitates the use of dusters. When sand, sawdust and coarse road dust were used, many grains of Paris green would cling to one large particle of the diluent, and the uneven blending of the dust resulted in the waste of much of the poison. Moreover, the use of dusters enables the same area to be covered with one-fortieth the amount (by weight) of diluent and one-tenth the amount of Paris green formerly used, despite the fact that the proportion of Paris green has now been increased from one to three per cent. by volume to augment the rapidity of the kill.

Other measures discussed include whitewashing the walls of labourers' quarters to discourage mosquitos from resting on them, and spraying or catching the adults by hand.

STRONG (R. P.). **Onchocerciasis in Guatemala. Preliminary Report.**—*20th Ann. Rep. Med. Dept. United Fruit Co. 1931*, pp. 152–160. Boston, Mass. [1932.]

During 1931, investigations were carried out in Guatemala on onchocercosis (caused by *Onchocerca caecutiens*), which is prevalent in certain areas on the Pacific slopes of the volcanic ranges. In this country the parasite is carried by *Simulium* (*Eusimulium*) *avidum*, Hoffm., *S.* (*E.*) *ochraceum*, Wlk., and *S.* (*E.*) *mooseri*, Dampf. The development of *O. caecutiens* within the fly is described. Of 1,658 Simuliids captured at random near villages, about 5 per cent. were found to be infected. All stages of development have been repeatedly observed in the fly from the microfilariae ingested from the skin of the infected individual to the mature infective filarial form in the thoracic muscles, head and proboscis, and permanent specimens have been secured showing the infective filarial form passing through and emerging from the labium of the proboscis. The microfilariae are found in the lymphatics of the skin and are not naturally encountered in the blood ; thus they are not ingested by mosquitos fed on infected individuals. Possibly also the saliva of the mosquito repels them. As the species of *Simulium* concerned in transmission are widely distributed in practically every swiftly flowing stream in the infected areas, the eradication of these flies is probably impracticable.

HASE (A.). **Beobachtungen an venezolanischen *Triatoma*-Arten, sowie zur allgemeinen Kenntnis der Familie der Triatomidae (Hemipt.-Heteropt.). Beiträge zur experimentellen Parasitologie 8.** [Observations on Species of *Triatoma* from Venezuela with Contributions to a general Knowledge of TRIATOMIDAE. Contributions to experimental Parasitology 8.]—*Z. Parasitenk.*, iv, no. 4, pp. 585–652, 1 pl., 26 figs., 4 pp. refs. Berlin, 5th September 1932.

This paper includes a list of the 72 known species of Triatomid bugs, with notes on their synonymy and distribution, a general outline of their anatomy and a key to the genera. Of these bugs 15 are said to be vectors of *Trypanosoma* (*Schizotrypanum*) *cruzi*, the causal agent of Chagas' disease, but it is still uncertain whether this trypanosome is transmitted by the bite of the insect or by the mechanical rubbing into the skin of its excreta. From Venezuela 11 species are recorded, 6 as vectors of the disease. The climatic and ecological conditions of the district in which the bugs were collected by the author are discussed with reference to earlier accounts. During their transport from Venezuela to Berlin, they were subjected in Europe to temperatures below freezing point, but all revived after exposure to 25°C. [77°F.] in the laboratory, indicating the possibility of their survival when accidentally distributed by ships. It was necessary to take special precautions against the ant, *Iridomyrmex humilis*, Mayr, which, both in South America and on the ship, entered the cages and destroyed many of the bugs. The method of maintaining the insects in the laboratory, their feeding habits and the amount of food ingested by various individuals are discussed. In Venezuela, eggs of *Panstrongylus geniculatus*, Latr., hatched in 21-26 days, those of *Eratyrus cuspidatus*, Stål, in 7–9, and those of *Rhodnius pictipes*, Stål, in 13–20.

HEARLE (E.). **Notes on the more important Mosquitoes of Western Canada.**—*Proc. 19th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1932*, pp. 7–15. New Brunswick, N.J., 1932.

Brief general accounts are given of the incidence and control of the species of *Aëdes* occurring in the Prairie Provinces of Manitoba, Saskatchewan and Alberta, and in British Columbia and the mountain sections of Alberta, together with notes on the bionomics of the individual species.

WILLIAMS (L. L.). **Mosquito Control Activities and Investigations of the United States Public Health Service.**—*Proc. 19th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1932*, pp. 64–67. New Brunswick, N.J., 1932.

In the course of a brief review of the more important activities of the United States Public Health Service in connection with mosquito control, the author reports that the larvicide consisting of an oil extract of pyrethrum [*R.A.E.*, B, xix, 128] has been successfully used as a spray for killing the adults of *Aëdes sollicitans*, Wlk., in the open. The undiluted extract liberated from a knapsack sprayer at the usual rate of oil application on the windward side of a marsh in a gentle breeze appeared to kill practically all adult mosquitos over a path about 60 ft. wide.

McNeel (T. E.). **Observations on the Biology of** *Mansonia perturbans* **(Walk.). Diptera, Culicidae.**—*Proc. 19th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1932*, pp. 91–96, 2 pls., 3 refs. New Brunswick, N.J., 1932.

An account is given of both field and laboratory observations on the bionomics of *Mansonia perturbans*, Wlk., the most important of the two species of this genus that occur in the United States. In laboratory tests fairly satisfactory control of larvae was obtained with Paris green and with sodium fluosilicate, but in the field the same materials were entirely unsatisfactory. When larvae are placed in a jar with a plant that has its roots covered with peat, they burrow into the peat to attach themselves to the roots. *Mansonia* breeds in marshes that have several inches of peat on the bottom, and, if the above procedure takes place in nature, the poisons used never reach the larvae. Unsatisfactory results were also obtained with emulsified kerosene extract of pyrethrum.

Vannote (R. L.). **The Use of the Aeroplane for the Distribution of Oils and Larvicides.**—*Proc. 19th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1932*, pp. 97–101, 2 pls. New Brunswick, N.J., 1932.

An account is given of experiments undertaken to determine whether dusts or sprays could be economically distributed against mosquito larvae by aeroplane. Dusts of fuel oil or pyrethrum larvicide mixed with sawdust or peat moss proved unsatisfactory. A preliminary account of the experiments with sprays has already been noticed [*R.A.E.*, B, xx, 176], but there are several discrepancies in the two papers. The spray was contained in a 90 U.S. gal. aluminium tank and discharged from a cross pipe 9 ft. long through holes $\frac{1}{4}$ inch in diameter. Tests with pyrethrum larvicide were not satisfactory, and it was concluded that the wind-driven agitator was not sufficiently powerful to keep the larvicide thoroughly mixed. Owing to the cost of a power-driven agitator, experiments with this spray were discontinued. An area of 8 acres was sprayed with 180 U.S. gals. fuel oil in 40 mins., and a mortality of approximately 98 per cent. of all larvae and pupae was obtained one day after spraying. Even where the grass was more than 4 ft. high, the oil mist reached the surface and deposited a killing film. The total cost of spraying by aeroplane, including labour and material, was a little more than half the estimated cost of spraying by hand, and it is not considered possible to obtain a mortality of 98 per cent. with the latter method. Further trials corroborated these results. By this means spraying can be accomplished in a very short time, places otherwise inaccessible can be reached, the cost is reduced and the results are superior to hand spraying. The disadvantages are that only open areas devoid of trees can be successfully sprayed, scattered ponds cannot be treated economically from the air, the services of a skilful pilot are necessary to secure good results and avoid serious accidents, and as the cost of the aeroplane is based on flying time, it is necessary to have a landing field in the vicinity.

HEADLEE (T. J.). **The Development of mechanical Equipment for sampling the Mosquito Fauna and some Results of its Use.**—*Proc. 19th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1932,* pp. 106–126, 2 pls. New Brunswick, N.J., 1932.

The author describes the work carried out in connection with the production of a more satisfactory trap for sampling the adult mosquito fauna of a locality [*cf. R.A.E.*, B, xvii, 139]. The trap finally evolved consists principally of a horizontal metal cylinder to which the mosquitos are attracted by a 50-watt white light backed by a reflector; they are subsequently drawn in by an air current from an electric fan set behind the light and finally trapped at the far end of the cylinder in a mosquito net bag, or are killed by falling into a cyanide jar or by coming into contact with electrified wires. The entrance is covered with a ½-inch mesh screen to prevent the trap becoming clogged with large moths, and the cylinder is fitted with a vane and ball bearings to ensure its facing the wind. This trap catches more than twice the number of mosquitos caught by an expert collector working under the same conditions for the same length of time, and appears to trap all economic species in approximately the proportions in which they occur. It was noted that flight is inhibited by rainfall and by temperatures below 60°F.

SMITH (L. W.). **One Year's Experience with Pyrethrum Larvicide.**—*Proc. 19th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1932,* pp. 128–131. New Brunswick, N.J., 1932.

Tests undertaken to determine whether the mosquito larvicide prepared from an oil extract of pyrethrum [*R.A.E.*, B, xix, 128], which has been successfully used on fresh water, could be employed on salt marshes, showed that it mixes well with salt water and effectively controls both larvae and pupae when applied in dilutions of 1 : 15. Its toxicity lasted for about 2 days, which was sufficient in an area subjected to weekly inspection and oiling. Moreover, a heavier and more lasting oil would not give greater protection, since the high tides would wash away the film within a comparatively short period. The cost of preparing 150 U.S. gals. concentrated larvicide is given; when diluted it was found to cost little more than a quarter the price of the fuel oil previously used. Being concentrated, the larvicide can be stored in smaller tanks, and fewer journeys have to be made by the operator to the supply station. It leaves no stains, is less destructive to boots, and does not injure plant or animal life or burn the skin of the worker.

[**Mosquito Control Work and Methods.**]—*Proc. 19th Ann. Mtg. New Jersey Mosquito Exterm. Ass., Atlantic City, 1932,* pp. 37–52, 52–55, 79–81, 102–105, 131–132. New Brunswick, N.J., 1932.

Reports on local mosquito situations and control work in several States are given.

Other papers included are: What Workers with Mosquitoes have accomplished around the World in 1930 and 1931, by F. C. Bishopp (pp. 15–35); The Development and Use of Machinery for Crushing Grasses, Reeds and Sedges on the Salt Marshes, by J. P. Peterson (pp. 70–72); and The Aeroplane as an Aid in Inspection and Survey Work, by F. W. Miller (pp. 73–78), in which the author points out that aeroplanes may be economically used not only to detect flooded areas due to defects in the drainage systems of marshes and to discover potential breeding-places in virgin territory, but also to locate flat roof tops holding water that may prove to be mosquito breeding-places.

MAYNE (B.). **Note on experimental Infection of** *Anopheles punctipennis* **with Quartan Malaria.**—*Publ. Hlth. Rep.*, xlvii, no. 35, pp. 1771–1773. Washington, D.C., 26th August 1932.

In the course of treating paretics with malaria, it was found that negroes were almost entirely refractory to benign tertian but developed severe attacks of malaria after direct blood inoculation with quartan malaria. For this reason experiments were carried out on the infection of three species of Anophelines with *Plasmodium malariae* by allowing them to feed on gametocyte carriers. Among 157 *Anopheles punctipennis*, Say, 39 *A. quadrimaculatus*, Say, and 7 *A. crucians*, Wied., only six infections were obtained, all in *A. punctipennis*. These were found on the 4th, 5th, 6th, 15th, 21st and 25th day after the infecting feed, and only in the last case were sporozoites observed in the salivary glands. It thus appears that infection with this form of malaria is not easy to obtain in any of these Anophelines [*cf. R.A.E.*, B, xx, 97].

METCALF (C. L.). **Black Flies and other biting Flies of the Adirondacks.**

METCALF (C. L.) & SANDERSON (W. E.). **Control of Biting Flies in the Adirondacks.**—*N.Y. St. Mus. Bull.*, no. 289, 78 pp., 33 figs., 28 refs. Albany, N.Y., January 1932. [Recd. August 1932.]

During July and August 1929, a preliminary survey was made of a large area in the Adirondack Mountains, New York State, where various biting flies cause such intense annoyance to man that the potential value of the area is estimated to be reduced by 40–50 per cent. In the first paper (pp. 5–58), a somewhat popular account is given of the appearance, life-history and habits of Simuliids, of which the most prevalent was probably *Simulium venustum*, Say, Ceratopogonids, of which *Culicoides biguttatus*, Coq., was the only species of importance in 1929, the stable fly [*Stomoxys calcitrans*, L.], mosquitos, and Tabanids, of which *Chrysops lateralis*, Wied., was the most abundant.

In the second paper (pp. 59–72), various suggestions are made for the general mitigation of annoyance by these flies, and certain measures are recommended for the control of the individual groups. The most prolific breeding-places of Simuliids are usually found where water flows rapidly over or round any kind of obstruction. For this reason water flowing over a dam should have a sheer, unobstructed drop into a pool reinforced at the bottom to prevent erosion. It is also recommended that dams should have two or more outlets which may be closed successively at intervals of 3–5 days to bring about the complete desiccation of the spillways and the consequent death of the larvae. Where larvae are developing on the smooth stone bottoms of streams flowing over rock outcrops or over obstructions that cannot be removed, they may be brushed off with stiff stable brooms to prevent excessive breeding near dwellings. Tests made with silk bolting cloth and grit gauze with from 22 to 62 threads to the inch to determine whether Ceratopogonids could be excluded by screening, showed that no females of *C. biguttatus* passed through a bolting cloth with 50 meshes to the inch.

DUNN (L. H.). **An effective Method for collecting Ectoparasites from live Animals and Birds.**—*Psyche*, xxxix, no. 1–2, pp. 26–29. Cambridge, Mass., 1932.

The method described has been effectively used for some time to obtain fleas and lice from various animals. The legs and tail are secured and the animal placed in a glass jar. One edge of a towel is wrapped tightly round the neck and grasped to hold the animal upright, and the other is secured to the top of the jar by an elastic band. Chloroform is sprinkled on the towel close to the animal's neck, but not near enough to touch the skin, and the vapour, being heavier than air, readily penetrates through the towel to the bottom of the jar. The majority of the parasites drop to the bottom of the jar, and the few stupefied individuals that come up on to the head can easily be collected by dabbing them with a pledget of cotton wool wet with chloroform. After about four minutes, the animal is removed from the jar and the fur rubbed or combed to remove inert parasites. The jar is inverted over white paper and the parasites transferred to tubes of alcohol. The few that remain on the sides of the jar can be picked up by means of a dissecting needle wetted with alcohol. This method may also be applied to birds and has proved effective in clearing them of lice.

WAKELAND (C.). **Control of Bedbugs by Fumigation.**—*Extens. Circ. Idaho Coll. Agric.*, no. 38, 8 pp., 2 figs. [Moscow, Ida.], July 1931. [Recd. September 1932.]

Detailed instructions are given for fumigating houses with hydrocyanic acid gas against bedbugs [*Cimex*], using sodium cyanide and sulphuric acid.

BRUMPT (E.). **La fièvre boutonneuse et la fièvre pourprée des Montagnes Rocheuses sont deux maladies distinctes. Résultats de l'épreuve de l'immunité croisée dans les maladies exanthématiques.**—*C. R. Soc. Biol.*, cx, no. 28, pp. 1197–1199, 4 charts. Paris, 1932.

In cross-immunity experiments, guineapigs previously infected with Marseilles fever or with typhus became infected when inoculated with the virus of Rocky Mountain Spotted fever [*cf. R.A.E.*, B, xx, 182].

BRUMPT (E.). **Longévité du virus de la fièvre boutonneuse** (*Rickettsia conori*, **n. sp.**) **chez la tique,** *Rhipicephalus sanguineus.*—*C. R. Soc. Biol.*, cx, no. 28, pp. 1199–1202. Paris, 1932.

Infection with Marseilles fever was obtained in two persons inoculated with ticks (*Rhipicephalus sanguineus*, Latr.) that were the descendants of ticks collected in Marseilles 17½ months previously, and had been reared on dogs and hedgehogs (both of which are refractory to the disease). This confirms the hereditary transmission of the virus and its ability to persist without the intervention of a vertebrate host [*R.A.E.*, B, xix, 224 ; xx, 146]. This long hereditary conservation and the susceptibility of young puppies (demonstrated by Durand [xx, 101]), which infect healthy ticks in their vicinity, explain the frequent infection of ticks in regions where the disease is endemic.

The intraperitoneal inoculation of crushed ticks into two male guineapigs produced a disease identical with that described by Caminopetros [xx, 182]. Rickettsiae observed by the author in the bodies of the ticks were probably identical with those in the scrotal sack of the guineapigs. They are briefly described as *Rickettsia conori*, sp. n.

Combiesco (D.) & Zotta (G.). **Sur la transmissibilité héréditaire du virus de la fièvre boutonneuse (fièvre exanthématique de Marseille) chez la tique** *Rhipicephalus sanguineus.—C. R. Soc. Biol.*, cx, no. 28, pp. 1223–1224. Paris, 1932.

Marseilles fever was produced in persons inoculated in February 1932 with a suspension of crushed larvae obtained from the eggs of infected females of *Rhipicephalus sanguineus*, Latr., collected from dogs at Constantza in August 1931. This again confirms the hereditary transmission of the virus in the tick [see preceding paper].

Combiesco (D.) & Zotta (G.). **Fièvre boutonneuse (fièvre exanthématique de Marseille) après inoculation intra-oculaire expérimentale du produit de broyage de** *Rhipicephalus sanguineus.—C. R. Soc. Biol.*, cx, no. 28, pp. 1222–1223. Paris, 1932.

In certain cases of Marseilles fever, the fever and eruption have been preceded by ocular lesions, suggesting that in these instances the eye is the site of infection. This has been confirmed by two experiments in which conjunctivitis followed by infection was obtained by placing several drops of the product of crushed larvae of *Rhipicephalus sanguineus*, Latr., in the eye [*cf. R.A.E.*, B, xix, 92 ; xx, 99].

Mooser (H.). **Essai sur l'histoire naturelle du typhus exanthématique.** —*Arch. Inst. Pasteur Tunis*, xxi, no. 1, pp. 1–19, 21 refs. Tunis, 1932.

After briefly reviewing the work that has already been carried out on endemic typhus in the United States and Mexico and its relation to louse-borne epidemic typhus of the Old World, the author describes experiments on the infection of fleas with a strain of Old World typhus that had been maintained in guineapigs. Individuals of *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., and *Pulex irritans*, L., were kept in Weigl boxes and fed on the shaved abdomens of infected guineapigs and subsequently on uninfected ones. In the case of *Xenopsylla cheopis*, Roths., infected rats placed in a beaker with the fleas for a certain length of time were killed and replaced by normal rats. In neither case were the normal guineapigs or rats infected, but intraperitoneal inoculation of normal guineapigs with emulsions of these fleas gave positive results in the one experiment with *P. irritans* and in two out of three with *X. cheopis* ; two experiments with *C. canis* gave negative results. These preliminary experiments showed that the Old World strain is able to multiply within the flea although it does so with less regularity than the Mexican strain. It is thought that the 28 individuals of *P. irritans* failed to produce infection in the guineapigs on which they were fed because their excreta were retained in the box by the fine gauze covering [*R.A.E.*, B, xx, 50, 143]. The failure to obtain infection of the rats in the case of *X. cheopis* was probably due to the small number of fleas used (3 and 6 individuals respectively), for the excreta of fleas contain less virus than those of lice [xx, 143], and with the Mexican strain of the virus it has been found necessary to use a large number of fleas if regular positive results are to be obtained. For this reason further experiments were carried out with rats, using larger numbers of *X. cheopis*; and subinoculation of the tissues of rats left in contact with the fleas for 12–15 days produced scrotal swellings in guineapigs and fever in rats, symptoms similar to those produced by the Mexican strain.

It thus appears that after passage through rats and fleas, a strain of the virus from the Old World reproduces, at least temporarily, symptoms characteristic of the endemic American strains. All the author's Mexican strains and the strains of workers in the south of the United States, which are characterised in guineapigs by scrotal swellings from the first passages, were isolated from cases of endemic typhus. Two strains isolated from rats [xx, 50] behaved in a manner similar to human endemic strains. Two Mexican strains isolated during an epidemic of typhus showed little tendency to produce scrotal swellings. Previous workers experimenting with Mexican typhus in guineapigs isolated their strains during epidemic periods and observed that epidemics were produced only by the intervention of lice [*Pediculus humanus*, L.].

It thus appears that the Mexican virus not only becomes augmented in virulence for man by long passages through louse and man (epidemic typhus is the only serious form of the disease in Mexico, endemic typhus causing practically no mortality), but also produces different symptoms in guineapigs and rats after such passages. The occasional appearance of scrotal swellings that has been observed in Old World strains after prolonged passages through guineapigs would appear to indicate that these strains are also of murine origin.

In an addendum the author points out that the discovery of benign typhus in man, rats and fleas in France and Greece [xx, 99, 101, 183, etc.] confirms the fact that typhus is primarily a disease of rats, the human epidemic form being a secondary adaptation of the virus to the louse-man cycle [xx, 143].

Work carried out in Manchuria [xx, 100, 144–145] confirms that done in America, though the author points out that it is not desirable to apply the new name *Rickettsia manchuriae* to the causal organism. Moreover, the disease should not be identified with the exanthematic fever described from Brazil, which has been proved to be transmitted by the ticks, *Amblyomma cajennense*, F., and *Ornithodorus rostratus*, Arag., and is probably allied to Rocky Mountain spotted fever.

NICOLLE (C.). **Origine commune des typhus et des autres fièvres exanthématiques. Leur individualité présente.**—*Arch. Inst. Pasteur Tunis*, xxi, no. 1, pp. 32–42, 4 refs. Tunis, 1932.

The author agrees with Mooser's view, expressed in the preceding paper, that Old World or epidemic typhus and murine or endemic typhus are of common origin, but considers that the two diseases are now distinct and not that one is still being derived from the other. Moreover he also agrees with Mooser that the inapparent form of the disease produced in rats by epidemic typhus indicates the murine origin of the virus, but points out that this fact would appear to show that epidemic typhus is better adapted to rats (and therefore of more ancient origin in them) than endemic typhus, which produces much more serious symptoms. He suggests that from a common ancestor in eastern or southern Asia, epidemic typhus spread eastwards with the main human migrations, and endemic typhus westwards with the Malay migration, the rats being carried in boats and eventually reaching the coast of South America.

In the author's experience with the epidemic virus in guineapigs, only doubtful scrotal reactions were observed by exterior examination, but tunica lesions similar to those produced by intraperitoneal inoculation of the endemic virus were observed on autopsy, and even where these lesions were slight, smears showed the presence of rickettsiae. No increase in the manifestation of this symptom occurred with continued passages. The fact that scrotal swelling was observed more frequently in Mooser's experiments after passage of the virus through fleas indicates merely the development of a property already existing in a reduced state. Moreover, it has been observed in Athens, in guineapigs used for the maintenance of the murine virus, that the scrotal reaction diminishes with passage and finally disappears. The author considers, therefore, that this symptom in guineapigs is a characteristic too unreliable to be used to prove the unity of the two viruses.

The reactions produced by the two viruses in man, rats, lice [*Pediculus humanus*, L.] and fleas are discussed. In the case of epidemic typhus, the virus does not appear to remain in the brain of the rat after the probable date of recovery of the animal from the inapparent disease, whereas the virus of endemic typhus is conserved regularly for two months. When lice are infected with epidemic typhus, nine days are required for the excreta to become infective and the lice die in 15–20 days, whereas the endemic virus brings about the rupture of the intestinal cells in 5 days and the death of the louse follows almost immediately. This fact explains the scarcity of epidemics of murine typhus in man, for the louse would have little opportunity in 5 days to transmit the virus.

Rats and fleas appear to play little if any part in the conservation of epidemic typhus. In North Africa epidemic typhus is most prevalent in villages, where there are fleas and lice but from which rats are frequently absent, and it is much less prevalent in towns, where rats abound. Moreover, even if rats were infected with epidemic typhus, fleas on them, although becoming infected themselves, would have no reason to abandon their hosts, which seldom die from the disease, whereas the high mortality among rats infected with endemic typhus probably leads to the dispersion of infected fleas, which may eventually infect man.

The author concludes that the two diseases are distinct, the reservoir of epidemic typhus being man and its vector the louse, and the reservoir of endemic typhus the rat and other Murids and its vector the flea ; in eastern Europe and northern Africa epidemic typhus disappears when lice are controlled and does not reappear even in isolated cases. He considers the two strains of the virus isolated in Mexico during a severe outbreak that showed the characteristics of epidemic typhus to be true epidemic typhus brought over to America by the Spaniards.

Nicolle (C.), Anderson (C.) & Laigret (J.). **Etude des trois premiers cas de fièvre récurrente hispano-africaine observés en Tunisie et, plus spécialement, de leurs virus.**—*Arch. Inst. Pasteur Tunis*, xxi, no. 1, pp. 43–72, 8 refs. Tunis, 1932.

An account is given of three cases of relapsing fever due to spirochaetes of the group *Spirochaeta hispanica* in northern Tunisia, including one already noticed [*R.A.E.*, B, xix, 90, 199]. Although no history of tick bite was given and search for the vector proved negative, the authors consider that the disease was transmitted by *Ornithodorus erraticus*, Lucas. The behaviour of the three strains of spirochaetes in laboratory animals is described. Cross-immunity experiments using these three strains and one isolated from ticks in Morocco confirm the authors' previous conclusions that there are no species among the spirochaetes of relapsing fever, but individual strains that may be arranged in groups according to their pathogenicity and their vectors [xviii, 18, 19; xix, 156]. The experimental transmission of two of the Tunisian strains by several species of ticks also confirms previous findings [xix, 18, 91]. Although negative results had been obtained with one of these strains in an experiment with lice [*Pediculus*] [xix, 91], a partial adaptation was obtained in one out of two experiments with the other. Lice infected 4–12 days previously by feeding on an infected monkey were placed on a normal monkey, which did not become infected, but 50 lice removed from this monkey and appearing negative when examined by ultramicroscope were inoculated under the skin of a third monkey, which developed typical relapsing fever after an incubation period of 7–12 days. The spirochaetes had therefore been preserved in the lice for at least 6 days, but the adaptation is considered incomplete since no spirochaetes had been observed in them [*cf.* xiv, 194; xviii, 18].

Buxton (P. A.). **Studies on the Biology of Fleas.**—*London Nat.*, 1931, pp. 39–42. London, 1932.

The author reviews certain investigations carried out by Bacot on the biology of fleas and their relation to the transmission of plague [*cf. R.A.E.*, B, ii, 60, 62, 131] and briefly points out the advances in knowledge that have been made on the foundations laid by him.

Caminopetros (J.) & Contos (B.). **Transmission de la fièvre boutonneuse au cobaye.**—*C. R. Acad. Sci. Fr.*, cxcv, no. 12, pp. 546–548, 1 ref. Paris, 1932.

The author has now succeeded in obtaining transmission of Marseilles fever to guineapigs by inoculation of large doses of blood from patients or experimentally infected animals [*cf. R.A.E.*, B, xx, 182]. Cross-immunity and serological tests showed this disease to be distinct from murine and epidemic typhus.

[Novikova (E. I.) & Lalazarov (G. A.).] **Новикова (Е. И.) и Лалазаров (Г. А.). The Rôle of Bed-bugs in the Epidemiology of Plague. i. The Duration of Viability of Plague Virus in the Body of the infected Bed-bug.** [*In Russian.*]—*Rev. Microbiol.*, x (1931), no. 4, pp. 315–324, 1 fig., 24 refs. Saratov, 1932. (With a Summary in English.)

This paper is the first of a series on the possible relation of *Cimex lectularius*, L., to plague, and it describes preliminary investigations on the time the bugs harbour infection. The literature on the subject is reviewed. The experiments, in which 1,793 bed-bugs taken in houses were used, were carried out at temperatures of 14–18°C. [57·2–64·4°F.] and about 3°C. [37·4°F.]. The bugs were fed on dying mice and rats infected with a virulent strain of plague. From the moment of feeding they discharged faeces during a period of about one month, or longer if feeding was repeated on healthy animals, defecation being more frequent at the higher temperature. In 37 per cent. of the cases the faeces contained *Bacillus pestis*, the maximum number of bacilli being found between the fifth and twelfth day after the meal. Except in a few instances, plague bacilli were abundant in cultures of infected bugs prepared immediately after their death, which usually occurred within 30 days after they had fed. Under identical conditions infected bugs lived for a considerably shorter period than normal ones ; three of them lived for 186, 222 and 250 days respectively, but emulsions of these bugs did not contain *B. pestis* and failed to produce infection in laboratory animals. In one instance, a bug caused infection in a healthy mouse when fed on it 78 days after the original feed ; a culture of plague bacilli was obtained from another 147 days after it had been infected, and injection of an emulsion of it produced the disease in laboratory animals. Starving the bugs before the infecting meal had no effect on the length of time the infection persisted in them.

[Tumanskiĭ (V. M.) & Polyak (I. M.).] **Туманский (В. М.) и Поляк (И. М.). Preservation of the Plague Virus in the Organism of the Fleas of the Nests of Ground Squirrels during a non-epizootic Period.** [*In Russian.*]—*Rev. Microbiol.*, x (1931), no. 4, pp. 325–326, 3 refs. Saratov, 1932. (With a Summary in English.)

In laboratory experiments [*R.A.E.*, B, xvi, 220] with fleas associated with ground squirrels [*Citellus* spp.] in south-eastern Russia, Golov and Ioff found that plague infection could persist for 180 days in *Neopsylla setosa*, Wagn., 203 in *Frontopsylla semura*, Wagn. & Ioff, 204 in *Ctenophthalmus pollex*, Wagn. & Ioff, 396 in *C. breviatus*, Wagn. & Ioff, and 275 in *Ceratophyllus tesquorum*, Wagn. To ascertain whether the fleas harbour the infection for long periods under natural conditions, collections were made in the winter of 1930–31 from the nests of ground squirrels in the eastern part of the former Province of the Don Cossacks, where a heavy epizootic of plague had occurred in the preceding spring. This outbreak apparently terminated at the end of June, as no infected ground squirrels could be found in July and August. Of 1,797 fleas examined, five (two *N. setosa* and three *C. pollex*) proved to be infected. The infection was determined by the method of Buichkov and Borzenkov [xvii, 131]. These experiments indicate that infection may persist for as long as five months in fleas occurring in the nests of ground squirrels.

[Tiflov (V. E.) & Ioff (I. G.).] **Тифлов (В. Е.) и Иофф (И. Г.). Observations on the Biology of Fleas.** [*In Russian.*]—*Rev. Microbiol.*, xi, no. 2, pp. 95–117, 19 refs. Saratov, 1932. (With a Summary in German.)

A detailed account is given of laboratory investigations, most of which were carried out in 1926 and 1927, on the biology of fleas, chiefly those that are found on steppe rodents in the endemic plague region in the south-east of European Russia. The species dealt with were :

Ceratophyllus fasciatus, Bosc, which usually occurs on rats; *Leptopsylla segnis*, Schönh. (*Ctenopsylla musculi*, Dug.), which attacks rats and mice; *Ceratophyllus tesquorum*, Wagn., *Neopsylla setosa*, Wagn., *Ctenophthalmus breviatus*, Wagn. & Ioff, *C. orientalis*, Wagn., and *Frontopsylla semura*, Wagn. & Ioff, which are usually associated with ground squirrels [*Citellus*]; *Oropsylla silantiewi*, Wagn., which is found on marmots; *Mesopsylla hebes*, J. & R., which is a parasite of jerboas; and the cat flea, *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch. The material for breeding was collected on the animals in the field and from their nests. The technique employed is described in detail, and a table is given showing the duration of the stages of the various fleas at different temperatures. A relative atmospheric humidity of about 90–92 per cent. was maintained all the time. The results obtained are compared with those of Bacot in his experiments with common rat fleas and other species associated with human habitations [*R.A.E.*, B, ii, 62].

The eggs hatched in 5–9 days at a temperature varying from 14 to 27·5°C. [57·2–81·5°F.], and in 14–18 days at 9·5–12·7°C. [49·1–54·8°F.]. At 5·8°C. [42·4°F.] only two eggs hatched, in 58 and 63 days respectively, and both larvae soon died. This suggests, however, that the egg stage may also represent a resting phase of the flea. Under identical conditions the larvae of the various species completed their development in different lengths of time; those of the species parasitising steppe rodents developed in 12–24 days at 18–23°C. [64·4–73·4°F.] and in 36–95 days in a cellar at 10–12°C. [50–53·6°F.], the longest periods being required by those of *O. silantiewi*. The shortest larval stage (8–12 days) was observed in the case of *Ctenocephalides felis* and *Ceratophyllus fasciatus*. The length of the period in the cocoon is largely determined by conditions of temperature and varied from 7 to 29 days at 13–24°C. [55·4–75·2°F.], and from 29 to 373 days at 1–15°C. [33·8–59°F.]. Even under identical temperatures it varied greatly; larvae of *O. silantiewi* that formed cocoons on 30th September and were kept under the same conditions in a cellar gave rise to adults in 56, 77, 92, 211 and 240 days. The emergence of the adults of individual species took place at definite seasons, *F. semura* appearing in March, *Ctenophthalmus orientalis* in August and September, *C. breviatus* in September, and *N. setosa* at any time from the beginning of September until the end of the spring.

Under favourable conditions of temperature and humidity the rodent fleas endured starvation for from 4 to 292 days at 13–24°C., and from 6 to 369 days at 1–15°C. These figures considerably exceed those obtained in Bacot's experiments with "domestic" fleas. Species that occur chiefly in the nests of rodents (*N. setosa* and *Ctenophthalmus*) are able to withstand starvation longer than *C. tesquorum*, *O. silantiewi* and *L. segnis*, which shelter in the fur of the hosts. Fleas that had received one blood meal lived longer on the whole than unfed individuals. Of fleas fed periodically on laboratory animals at intervals of usually 1–2 months (the longest interval being 5 months in one instance), a female of *N. setosa* lived 1,725 days (4 years 8 months and 25 days), this period far exceeding any other maxima recorded. At 13–24°C. 17 per cent. of the starved fleas and 26·1 per cent. of those that had only one blood meal lived for 250 days, and in a cellar at 1–15°C. (under conditions approaching those of the nest of *Citellus pygmaeus* during the hibernation period) the percentages of fleas that lived for this time were 60·7 when starved and 71·1 when fed once. Fleas only survived for as long as 350 days at 1–15°C., the percentage that did so being 0·8 when starved, and 10·5 when fed once. Of fleas kept at temperatures varying from —2 to 15°C. [29·4–59°F.] and periodically fed, 41·1 per cent. lived 350 days, 9·8 per cent. 750 days, 7·4 per cent. 1,100 days, and 2·9 per cent. 1,450 days. Provided that there was a constant humidity of about 90–92 per cent., the duration of life of both sexes was practically equal, but under conditions of atmospheric humidity they succumbed rapidly, the males sooner than the females, the percentages of mortality being 70·9 and 51·6 respectively on the first day of keeping the fleas in glass tubes.

Taking the different stages into account and provided that the adults were periodically fed, the maximum duration of life of individual species was as follows: *O. silantiewi* 683 days, *C. tesquorum* 803, *Ctenophthalmus orientalis* and *C. breviatus* 870, and *N. setosa* 2,052–2,108. These are not the figures as shown in the authors' table, in which the totals are increased by the addition of figures representing the number of days lived by unfed individuals. As investigations on transmission of plague by fleas have shown that the infection remains in them until their death [xviii, 247; xvi, 221], the adult longevity obtained in these experiments is of special significance. It is necessary to take into account the fact that the fleas were fed at longer intervals than are likely to occur in nature, and that no oviposition took place, though in some experiments both sexes were kept together; probably the eggs in the ovaries did not mature owing to insufficient nutrition and in some instances to low temperature.

The fleas of rodents are less active than those associated with human habitations; *O. silantiewi* is especially sluggish and does not abandon a dead host for a long time, frequently remaining in the fur of the marmot after skinning. Tests showed that the maximum and average distances an adult of *N. setosa* jumps are 11·5 and 7·5 cm., the corresponding figures for *C. breviatus* being 11 and 6·8 cm. and for *C. tesquorum* 14 and 9·2 cm. Fleas that had recently fed were more active than starved individuals.

[ZASUKHIN (D.) & TIFLOV (V. E.).] **Засухин (Д.) и Тифлов (В.). The Endo- and Ectoparasites of the Steppe Ground Squirrel**—*Citellus pygmaeus* **Pall.** [*In Russian.*]—*Rev. Microbiol.*, xi, no. 2, pp. 129–132, 46 refs. Saratov, 1932.

This is a preliminary list of the endo- and ectoparasites of *Citellus pygmaeus*, a reservoir of plague in the south-eastern steppes of European Russia, and includes 6 species of ticks and 17 of fleas, with indications of the frequency of their occurrence and references to the literature on the subject.

D'HERELLE (F.). **Clover and Malaria.**—*Amer. J. Hyg.*, xvi, no. 2, pp. 609–617, 8 refs. Baltimore, Md., September 1932.

In view of the fact that in recent years various workers have performed experiments with the object of verifying the author's hypothesis regarding the effect of plants containing coumarin, particularly sweet clover (*Melilotus*), on the incidence of malaria, he points out that he did not suggest that coumarin destroys the malarial parasites in the mosquito but that it attenuates their virulence. Thus the experiments of Mayne [*R.A.E.*, B, xviii, 143] showing that coumarin has no effect on gametogenesis or on developing oöcysts does not contradict the hypothesis but only the interpretation of Willcocks [xvi, 26], who stated that clover flowers probably contained a plasmodicidal agent capable of sterilising Anophelines of their malarial parasites.

Stratman-Thomas selected various fields in which lucerne had been planted 1–3 years previously, and as there were no significant differences in the indices showing the incidence of malaria at various distances from these fields, he concludes that clovers have no action [xix, 249]. The author points out that it is not certain that all species have a comparable action. Moreover, the method used by Stratman-Thomas would be valuable only in cases where malaria was an acute disease, whereas he admits the likelihood that little transmission was taking place in 1930 and that the infections encountered were probably largely chronic and attributable to the malaria season of 1929 or previous years.

If the hypothesis is correct, the sowing of an efficacious plant in a malaria region would only produce a gradual diminution of malaria, for the action is on the parasite within the mosquito and not in man, who will continue to suffer from relapses. The gradual attenuation of the parasite and the consequent diminution in the number of persons, particularly infants, carrying it in their blood will ultimately result in the disappearance of malaria, the length of time required to bring this about being related to the efficacy of the species of clover and the area and location of the clover fields. With regard to Stratman-Thomas's contention that the gradual decline in malaria incidence in the delta section of Mississippi since the introduction of lucerne is due not to lucerne itself but to the conditions, particularly drainage, necessary for its cultivation, the author points out that cotton and maize, which also need drainage, have been grown extensively in Mississippi for more than a century without causing a similar reduction in the amount of malaria.

He considers that the only fair means of testing the hypothesis within a relatively short period of time would consist in taking the malarial index of children born near clover fields since the first flowering of the crop and comparing it with the malaria incidence of the rest of the population. As a control, the same two indices should be taken in the same region at a distance from clover fields sufficient to preclude the effect of clover on the mosquitos. The repetition of this procedure for a number of years would lead to a definite conclusion. Moreover, it would permit the testing of the relative values of various species of clover. The only group of the population that Stratman-Thomas found free from malarial parasites was that of children under two years, the exact period of time elapsing since the first flowering of the lucerne planted three years before.

HUFF (C. G.). **Studies on Haemaproteus of Mourning Doves.**—*Amer. J. Hyg.*, xvi, no. 2, pp. 618–623, 1 fig., 8 refs. Baltimore, Md., September 1932.

The author discusses the infection of birds with parasites of the genus *Haemaproteus* and gives an account of experiments in which *H. sacharovi* and *H. maccallumi* in doves from Illinois were transmitted to pigeons by the fly, *Pseudolynchia maura*, Big. *H. sacharovi* is described ; it appears doubtful whether *H. maccallumi* is distinct from *H. columbae*.

PINTO (C.). **Simulidae da America Central e do Sul.** [SIMULIIDAE of Central and South America.]—*7. Reun. Soc. argent. Pat. reg. Norte, Tucuman, 1931*, pp. 661–673, 41 figs. Buenos Aires, 1932.

This is a revision of the SIMULIIDAE of Central and South America, including Mexico and a few of the West Indian Islands. The species are dealt with individually under the country in which they occur, showing their synonymy and distribution, and a key to the pupae is given. The new species described are *Simulium angrensis*, *S. baiensis*, *S. brachycladum* (which is described by Lutz & Pinto) and *S. catarinensis* from Brazil, and *S. lutzianus* from Venezuela.

[V. SCHUCKMANN (W.).] **Die Mückenplage und ihre Bekämpfung.** [The Mosquito Pest and its Control.]—4th edn., 40 pp., 12 figs., 1 pl. Berlin, J. Springer, 1932. Price *M*.1.

This pamphlet describes the bionomics of mosquitos that are troublesome in Germany and gives recommendations for measures against the larvae and pupae and for the destruction of adults hibernating in houses.

PAPERS NOTICED BY TITLE ONLY.

SOESILO (R.). *Anopheles* (*Bironella*) *walchi* **n. sp.** [described from the larva in Netherlands New Guinea].—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 16, pp. 1035–1036, 1 fig. Batavia, 2nd August 1932.

BEQUAERT (J.). *Amblyomma dissimile* **Koch, a Tick indigenous to the United States (Acarina : Ixodidae).**—*Psyche*, xxxix, no. 1–2, pp. 45–47, 1 fig. Cambridge, Mass., 1932.

BEQUAERT (J.). **On the Ornate Nymphs of the Tick Genus** *Amblyomma* **(Acarina : Ixodidae).**—*Z. Parasitenk.*, iv, no. 4, pp. 776–783, 2 figs., 2 refs. Berlin, 5th September 1932.

JORDAN (K.). **Die Siphonaptera Bulgariens.**—*Mitt. naturw. Inst. Sofia*, v, pp. 145–148. Sofia, 1932.

WAGNER (J.). **Die Bedeutung der Flöhe für die Frage nach der Genesis der Säugetierfauna.** [The Importance of the Flea in the Problem of the Origin of Mammals (including description of *Coptopsylla africana*, sp. n., from Tunisia).]—*Zoogeographica*, i, no. 2, pp. 263–268, 1 fig., 3 refs. Jena, July 1932.

WAGNER (J.). *Neocoptopsylla wassiliewi* **g.n., sp. n.** [in nests of *Meriones* sp. in Tunisia] **und** *Coptopsylla africana* **Wagn.** [further description].—*Konowia*, xi, pt. 2, pp. 168–175, 7 figs., 2 refs. Vienna, 1st August 1932.

RIES (E.). **Die Symbiose der Pediculiden und Mallophagen.**—*Arch. zool.*, xvi, no. 3–4, pp. 1408–1421. Torino, 1932. [*Cf. R.A.E.*, B, xviii, 216.]

Reports of the Kala-azar Commission, India. Report no. II (1926–1930).—*Ind. Med. Res. Mem.*, no. 25, 200 pp., 1 pl., 1 fig., 1 chart, 6 pp. refs. Calcutta, August 1932.

The epidemic of kala-azar that began in India about 1917 and reached its peak about 1924–25 began to decline in 1926, and, although abundant material for experimental work was available up to 1928, in 1929 and 1930 the supply was insufficient to justify the maintenance of an organisation on the scale of the Kala-azar Commission. Moreover, the character of the disease had altered from the acute, fulminant type to the more chronic form prevailing during inter-epidemic periods, a type much less suitable for experimental work on transmission. For these reasons the Commission ceased work in February 1931 after conducting investigations in the field since 1924. Its work up to October 1925 was dealt with in the first report [*R.A.E.*, B, xiv, 135, etc.], and in order to complete the account of its activities in a convenient form, the present memoir gives summarised versions of reports issued from 1925 to 1930 [most of which have already been noticed in this *Review*], together with a few papers not previously published. Information of entomological interest is noticed below. The reproduction of all the original plates and figures has not been possible, and the references originally given with the separate papers have been collected in an appended bibliography. The general results of the work of the Commission are briefly outlined, and a calendar gives the dates of the more important findings that have been made.

SHORTT (H. E.). **Notes on recent Research in India on the Transmission of Indian Kala-azar.**—*Ind. Med. Res. Mem.*, no. 25, pp. 65–69, 1 ref. Calcutta, August 1932.

This paper, which was first published in the Proceedings of the Assam Branch of the British Medical Association, 1930, reviews the research work carried out on kala-azar from 1926 to 1929. The points in favour of the two theories of transmission, by sandflies, particularly *Phlebotomus argentipes*, Ann. & Brun., or by contaminative means *via* the alimentary canal, are summarised in a table.

SHORTT (H. E.), SMITH (R. O. A.) & SWAMINATH (C. S.). **Miscellaneous Experiments with** *Phlebotomus argentipes* **in Relation to Transmission of Kala-azar.**—*Ind. Med. Res. Mem.*, no. 25, pp. 90–102, 3 refs. Calcutta, August 1932.

The series of experiments dealt with in this paper have no direct connection with one another and have been brought together merely to complete previous accounts and to put on record the remaining unpublished work of the Kala-azar Commission in connection with the possible transmission of kala-azar by *Phlebotomus argentipes*, Ann. & Brun.

Negative results were obtained when sandflies infected with *Leishmania donovani* were fed repeatedly on a series of six white mice. Attempts to demonstrate by cultural methods the presence of *L. donovani* in wounds caused by the proboscis of infected individuals of *P. argentipes* were unsuccessful. In three series of experiments, Chinese hamsters [*Cricetulus griseus*] were fed on sandflies infected by feeding them naturally on man, or artificially on cultures of

L. donovani and emulsions of liver and spleen containing Leishman-Donovan bodies. One positive result was obtained in the third series [*R.A.E.*, B, xix, 237]. The artificial feeding of sandflies in these experiments was carried out by means of a simplified form of the technique used by Hertig and Hertig [xv, 160]. The feeding pipette was a piece of sterile glass capillary tubing drawn out in a very small flame to an almost hairlike thickness and broken across as squarely as possible. This was heated about half an inch from its end until it bent over at right angles, and the point was then momentarily applied at intervals to a minute flame until the aperture assumed a smooth edge and was sufficiently small to admit the proboscis but not the labium of the sandfly. The wings of a sandfly, anaesthetised by ether and held in forceps by the legs, were inserted into a slit in a cork of any convenient size. A piece of string may be tied round the cork if it is necessary to increase the pressure on the wings. The cork with the immobilised fly is placed on the stage of a dissecting microscope and steadied with one hand. The feeding pipette is dipped into the proposed meal, which flows up it by capillarity. The aperture of the pipette is then brought up to the proboscis of the fly, and if the size has been correctly gauged, the piercing organs of the fly enter the lumen of the pipette while the labium is bent backwards at an angle. Once the fly had been infected by an artificial feed, it was kept alive by allowing it to feed naturally on a rabbit. In the case of flies fed on cultures of *L. donovani*, about 20 per cent. re-fed naturally, but in the case of those fed on emulsions of liver and spleen, only about 6 per cent. re-fed naturally. There seemed to be a much greater initial mortality in the latter series, possibly due to the deleterious effect of the citrated saline used in making the liver and spleen emulsions or even of extracts of these organs. Multiplication of the Leishman-Donovan bodies and conversion into the flagellate form is very rapid ; in 48 hours there is often a heavy flagellate infection and in some cases flagellates are present after only 24 hours. In flies that subsequently fed naturally, the infection became intense.

In Assam, the coldest period of the year is between mid-November and mid-February, and at this time only occasional individuals of *P. argentipes* are found. The numbers increase after mid-February, and in March and April the sandflies are prevalent in all suitable situations. In May and June there may be some diminution in their numbers, but after the advent of the monsoon in the latter month they increase progressively until they reach their maximum in September and October, when they again decline until by the beginning of December the adults have almost disappeared in nature. Although it is possible to feed *P. argentipes* in the laboratory throughout the year by keeping all stages at the optimum temperature of 28°C. [82·4°F.], the flies fed most readily at the time of year when they were most prevalent in nature, a fact that appears to indicate the presence of some innate biological factor influencing feeding habits and acting independently of immediate environment. The largest number of eggs is laid (with the lowest mortality among ovipositing females) during the period from March to October. During the optimum period, oviposition usually takes place between the third and fourth days after the initial feed ; during the rest of the year between the fourth and fifth day. This difference of one day is noted in the laboratory despite the fact that the flies are kept throughout the year under identical conditions of temperature and humidity. A blood meal is necessary between subsequent ovipositions, which usually take place at intervals of about 3 days. Occasionally as many as six batches of eggs are laid, the highest average number of eggs being found in the second batch and the number hatching decreasing in each successive oviposition. The proportions of the sexes are almost equal, and pairing seems to take place but once in the life of a female, usually before the first meal. In nature *P. argentipes* has always been found to choose situations for breeding inside or in the immediate neighbourhood of houses or animal sheds, and search of the soil in other apparently suitable situations has yielded negative results. The largest number of larvae is found at a depth of 1–5 ins. from the surface of the soil. Any organic material appears to serve as food for them, and as cow-dung is generally mixed with the earth used to smear the walls and floors of the poorer types of Indian dwellings, and most of the people keep domestic animals (often inside the dwellings), there is no scarcity of food material. In the laboratory, the larvae have been observed feeding on moulds growing naturally on the food material supplied.

SHORTT (H. E.), SMITH (R. O. A.) & SWAMINATH (C. S.). **Miscellaneous Experiments in Kala-azar.**—*Ind. Med. Res. Mem.*, no. 25, pp. 103–108, 8 refs. Calcutta, August 1932.

Among the miscellaneous experiments recorded is one in which 203 sandflies (*Phlebotomus argentipes*, Ann. & Brun.) were fed on a case of dermal leishmanoid, but none became infected. Microscopical dissection of an excised nodule from this case showed that the phagocytic cells containing *Leishmania donovani* were, with very few exceptions, too deeply placed to be reached by the piercing organs of the sandfly.

Thirty-six bedbugs (*Cimex lectularius*, L.) fed on a case of dermal leishmanoid showing face lesions were dissected at intervals of 4–7 days, and one dissected on the 5th day after feeding showed flagellate forms of *L. donovani* in the midgut.

SMITH (R. O. A.) & SWAMINATH (C. S.). **Notes on some** *Culicoides* **from Assam.**—*Ind. Med. Res. Mem.*, no. 25, pp. 182–186, 1 pl. Calcutta, August 1932.

Large numbers of midges may be collected at Gauhati, Assam, practically thoughout the year, the only noticeable diminution in numbers occurring during the very hot weather, usually in April and May. The species concerned are *Culicoides peregrinus*, Kieff. (with var. *assamensis*, n.), *C. oxystoma*, Kieff., which is very common and found feeding only on cattle, *C. anophelis*, Edw., found feeding directly on cattle or attached to *Anopheles fuliginosus*, Giles, or *Phlebotomus argentipes*, Ann. & Brun., *C. fulvithorax*, Aust., on cattle as well as man, *C. similis*, C., I. & M., on cattle and from cattle sheds, and *C. shortti*, sp. n., *C. albipennis*, sp. n., and *C. daleki*, sp. n.

MARSHALL (J. F.). **A Mosquito Summary.**—Cr. 4to, 8 pp., 7 figs. Hayling Island, Hants, Br. Mosquito Control Inst. [1932.] Price 9*d*.

The author briefly describes the morphology and bionomics of mosquitos in general, the characteristics distinguishing Anophelines from Culicines in all stages, the manner in which they transmit disease and the preventive and remedial measures usually employed for their control.

Sur (S. N.), Sarker (H. P.) & Banerji (K. M.). **Plasmochin as a Malarial Gametocide.**—*Ind. Med. Gaz.*, lxvii, no. 9, pp. 490–493, 7 refs. Calcutta, September 1932.

Investigations were carried out from March 1931 to February 1932 to determine the effect of small doses of plasmochin on the development of malaria parasites in Bengal mosquitos. *Anopheles fuliginosus*, Giles, *A. varuna*, Iyen., *A. stephensi*, List., *A. ludlowi*, Theo., *A. maculatus*, Theo., and *A. maculatus* var. *willmori*, James, were tested with *Plasmodium falciparum*, the first four with *P. vivax* and the first three with *P. malariae*. The mosquitos were fed on selected cases, which were then treated with 0·02 gm. plasmochin daily for 3 days, after which another batch of the same species was fed. After being kept at laboratory temperature on a diet of water and raisins for 12–15 days, the mosquitos surviving were dissected. Varying degrees of infection were found in all species with each parasite to which it had been exposed before the administration of plasmochin, but no parasites were found in any species fed on treated cases. In view of the difficulty usually experienced in obtaining infection of mosquitos with *P. malariae* [*cf. R.A.E.*, B, xx, 97, 242], it is of interest to note that the percentages of infection in these experiments were 2·3 in the case of *A. varuna*, 15·7 in *A. fuliginosus*, and 23·1 in *A. stephensi*. The total percentage of infection in *A. varuna* with all three parasites only amounted to 3·2, which indicates that this Anopheline is a feeble potential carrier compared with the other species. In blood examinations made after treatment, no parasites were observed in 17 cases infected with *P. vivax* ; 9 out of 17 cases with *P. falciparum* were free from parasites, but the remaining 8 showed rings and crescents, although their numbers were reduced ; and 7 out of 9 cases with *P. malariae* were negative, but in 2 cases trophozoites persisted for 3 days.

Jafar (M.). **Malaria in Mingaladon Cantonment, Burma.**—*Ind. Med. Gaz.*, lxvii, no. 9, pp. 493–498, 2 graphs, 1 map. Calcutta, September 1932.

In the course of a mosquito survey of this station, *Anopheles vagus*, Dön., which is the commonest mosquito, was found throughout the year breeding in clear and dirty water collections near the houses and lines. *A. subpictus*, Grassi, was breeding in small pools of dirty water, but since drainage has been improved and oiling undertaken, no further individuals have been taken. *A. maculipalpis*, Giles, was found during the dry weather chiefly in seepage collections, and disappeared more or less completely during the rainy weather. *A. minimus*, Theo., was more numerous during the dry months, and as no males were taken during the rains, it is concluded that the females found at this time had emerged before the rains began ; breeding occurred in a small watercourse fed by a spring. *A. hyrcanus* var. *nigerrimus*, Giles, was the most abundant species during the rainy weather and occurred with *A. barbirostris*, Wulp, in collections of water sheltered by vegetation. *A. jamesi*, Theo., *A. tessellatus*, Theo., and *A. pulcherrimus*, Theo., were taken during the dry weather, but their breeding-places were not located. The incidence of malaria increased during the rainy weather, and catches of adult mosquitos in houses revealed *A. hyrcanus* var. *nigerrimus*, *A. barbirostris* and *A. vagus*, in order of abundance. Dissection of 95 individuals of the first-named showed sporozoites in two, thus indicating that this species is a vector during the rainy season. In the dry weather, *A. maculipalpis* and *A. minimus* were the species predominating in the barracks in 1930, but after a breeding-place of the latter had been treated, it became scarce in 1931, when fresh cases of malaria almost certainly due to *A. maculipalpis* occurred. Notes are given on various species of fish that destroy mosquito larvae in the district, and their introduction into all collections of water is suggested.

SEN (S. K.). **The Control of Blood-sucking Insects in India.**—*Ind. J. Vet. Sci. Anim. Husb.*, ii, pt. 1, pp. 29–40, 2 pp. refs. Calcutta, March 1932.

The author discusses from the literature (chiefly abstracts in this *Review*) various attractants, repellents and traps that may be used for the control of blood-sucking Diptera.

KOPSTEIN (F.). **De biologie van de Huisspitsmuis** *Pachyura murina* **(L.) en hare beteekenis voor de epidemiologie der builenpest op Java.** [The Biology of the House Shrew, *P. murina*, and its Importance in the Epidemiology of Bubonic Plague in Java.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 20, pp. 1337–1349; no. 22, p. 1536. Batavia, 27th September & 25th October 1932.

The question whether plague in Java is chiefly spread by traffic [*cf. R.A.E.*, B, xx, 25, etc.] or by migrating rats or shrews is of importance. Observations there have shown that house rats hardly ever leave villages and do not provide a regular communication between one village and another. The author therefore investigated whether the house shrew, *Pachyura murina*, could carry plague from place to place. Over 10,000 houses were examined, about 1,000 being revisited repeatedly to check results. *P. murina* appeared to inhabit villages exclusively, leaving them only very exceptionally. About 46 per cent. of the shrews harboured fleas, of which *Xenopsylla cheopis*, Roths., was the commonest, the only others being *X. astia*, Roths., which was rare, and *Stivalius cognatus*, Jord. & Roths., which was taken twice. *P. murina* has usually a lower *cheopis* index than the house rat and is of practically no importance in the spread of plague from village to village, though within a given village it may be of significance as a reservoir. The author compares the divergences between his results and those of the Schuurmans [xix, 170] who found, for instance, that shrews outnumbered rats, had a higher *cheopis* index than the latter, and were capable of carrying plague from village to village. These authors, however, dealt with the musk shrew, *Crocidura coerulea*, which never enters dwellings and is therefore, in the present author's opinion, entirely outside the plague question. *P. murina* was never found in woods.

SCHUURMAN (C. J.). **Eenige opmerkingen naar aanleiding van twee artikelen van Kopstein op het gebied der pest-epidemiologie.** [Some Remarks on two Articles by Kopstein on Plague Epidemiology.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxxii, no. 20, pp. 1350–1358. Batavia, 27th September 1932.

Kopstein's papers [see preceding abstract and *R.A.E.*, B, xx, 218] and his criticism of the author's work [xix, 170] are discussed.

Handschin (E.). **A preliminary Report on Investigations on the Buffalo Fly** (*Lyperosia exigua* **de Meij.) and its Parasites in Java and Northern Australia.**—*Pamph. Counc. Sci. Ind. Res. Australia*, no. 31, 24 pp., 2 figs. Melbourne, August 1932.

Investigations on *Haematobia* (*Lyperosia*) *exigua*, de Meij. (buffalo fly) and its parasites were carried out in Java and northern Australia during 1930–32 [*cf.* *R.A.E.*, B, xx, 46], and this paper deals with the outstanding results obtained and their possible application in preventing the spread of the fly.

Observations in the field indicated that in the moist climate of Java only the primary hosts (buffalo and cattle) are attractive, whereas with increasing dryness of climate and acceleration of rate of evaporation from Sumbawa to North Australia, the flies cannot secure sufficient moisture, and secondary hosts (horses) become attractive. The female is attracted from the host to oviposit in dung up to one day old. The larval period usually occupies 8–10 days in Java and coincides with the primary fermentation of the dung. Humidity and temperature being the most important factors, the larvae move about the central layer of the dung, following the most suitable conditions. A temperature of 32°C. [89·6°F.] and a humidity of 50–52 per cent. are required at the time of pupation. Throughout the infested area the moisture content of dung and environment regulates the abundance [*cf.* xix, 158], and temperature the occurrence of the fly.

As a result of preliminary investigations on natural enemies with a view to biological control, *Spalangia sundaica*, sp. n., and *S. orientalis*, sp. n., of which descriptions by L. F. Graham are appended, were selected for further study. These parasites attack the pupae of *Haematobia* and various other Muscids, showing no apparent preference for any single species. Collections of *S. sundaica* were made in Java, where the rate of parasitism varied from 6 to 8 per cent., except in mountainous regions where 46 per cent. was recorded from *Stomoxys*; *S. orientalis* was found in northern Australia, where the rate of parasitism ranged from 1 to 6·8 per cent., and large numbers of infested host pupae were taken to Buitenzorg for experimental work. The life-cycle of both species from oviposition to the emergence of the adult occupies approximately 3 weeks; *S. sundaica* lays about 160–170 eggs over a period of about 27 days, and *S. orientalis*, though it attacked *H. exigua* more frequently in the field, only lays about 85 eggs over a period of about 15 days. Males of both species emerge earlier than females and are produced parthenogenetically. The parasites are not apparently directly influenced by humidity, and their incidence is correlated with fluctuations in host abundance. At 22°C. [71·6°F] the rate of development was retarded and at 35°C. [95°F.] accelerated, as compared with the usual laboratory temperature of 28–32°C. [82·4–89·6°F.]. Dung was found to be the chief and sole primary source of attraction. The males, which are negatively heliotropic, are attracted to drying dung more than 8–10 days old, in which the newly emerged females are to be found. Mating occurs as soon as they appear, and the females, which are positively heliotropic, migrate in search of dung 4–10 days old, in which the newly-formed puparia of the host are most likely to be present. This reaction to dung is characteristic of all forms of the genus from the Netherlands Indies to Australia, but is graduated in intensity, being strongest in those of Java and weakest in those of Australia.

When *S. sundaica* was bred for successive generations on pupae of *H. exigua*, the size of the individuals was greatly reduced, and the possibility of breeding a specific race was considered. However, this strain did not become fixed, nor did it show preference for *H. exigua* over other Muscids ; moreover, it reverted to the normal size when reared again on other Muscids after the second generation. In attempts to pair *S. sundaica* from the field with *S. orientalis*, males only were produced, but when the laboratory strain was employed, both sexes were obtained. Females of *S. orientalis* mated with males of *S. sundaica* lived 30–32 days instead of 15 and produced up to 240 eggs instead of 75–80, but when the reverse cross was effected, the activity and fecundity of the females was reduced. The laboratory races of *S. sundaica* were therefore introduced into Australia with a view to obtaining the more satisfactory cross and thus raising the percentage of parasitism in the field. At one place both sexes of *S. sundaica* were liberated, and in another, two miles away, males of *S. sundaica* together with females of *S. orientalis* already fertilised by males of *S. sundaica.*

Larvae of various predacious Muscids are the only other possible factors in biological control to which importance is attached. Diapriid parasites of the genera *Phaenopria* and *Trichopria* were observed in Java, but they were not abundant ; Chalcids were very rare, and though parasitic Staphylinids were more numerous, the Australian representatives of this group are more efficient than those of Java. Dung feeding insects were not found in sufficient numbers to be of value as competitors ; though in northern Australia *Oxytelus ocularis*, Fauv., appears in large numbers at the end of the wet season, entirely destroying fresh dung in one night, this Staphylinid is only effective for about one month and usually occurs in horse dung.

From an examination of the position as regards *H. exigua* in northern Australia and the Netherlands Indies, it is considered that its importance in the former region has been exaggerated, though it is difficult to predict the effect of its appearance in the dairying districts of Queensland and northern New South Wales, and strict quarantine measures should therefore be enforced. As a result of breeding experiments and to allow for variation over the month, 20°C. [68°F.] is considered for practical purposes the critical temperature for development. Stations having a monthly mean temperature of 68°F. or less may be placed outside the range of permanent occupation of the fly, for though it may be present for a time, it cannot survive the colder periods. No evidence of hibernation has been obtained. It is therefore unlikely that the fly will become established in the south of Western Australia, New South Wales or southern Queensland, where long periods of low temperature occur during the winter. The southern boundary of distribution will probably be just south of Rockhampton.

FULLER (M. E.). **The Blowfly Problem—Notes on the Effect of Carcass Burial.**—*J. Counc. Sci. Ind. Res. Australia*, v, no. 3, pp. 162–164. Melbourne, August 1932.

In view of the necessity for discriminating between primary and secondary blow-flies infesting sheep and directing control measures against the former, experiments were carried out to determine the effect of carcass burial on the flies. It was found that burial favours the primary flies and adversely affects the secondary ones. Ordinary compacting of the soil over the carcass does not seriously impede the wandering of the full-grown smooth maggots of the primary flies, which normally pupate just under the surface of the soil. The hairy secondary maggots generally pupate on or close to the carcass. On stations where burning is impracticable, burial of carcases may be necessary for sanitary reasons. In warm weather, particularly in the tropical parts of the country, eggs are laid in large numbers on an animal within an hour or two after its death, so that carcases are seldom found on a large station in time to bury them before they become infested. A further experiment showed, however, that slashing the carcass and spraying it with a solution of sodium arsenite, containing 0·5 per cent. white arsenic, effectively prevented the emergence of any flies. This provides a simple, cheap and effective method of dealing with this problem.

COUSIN (G.). **Etude expérimentale de la diapause des insectes.**—*Bull. Biol. Fr. Belg.*, Suppl., xv, 341 pp., 17 pp. refs. Paris, 1932.

This work is divided into 4 parts, of which the first deals with the conditions of breeding *Lucilia sericata*, Mg., in the laboratory, the development of its various stages, the experimental study of the diapause of various strains (including attempts to provoke it at different stages of development), the breaking of the diapause, the relation of one determining cause of diapause to another and the factors influencing the continuance of development after the diapause, and the influence of the diapause on metamorphosis and adult life. The second part is concerned with the effect of the diapause on increase in weight and on metabolism in *L. sericata*, and the third part deals with the diapause in *Calliphora erythrocephala*, Mg., *Phormia terrae-novae*, R.-D. (*groenlandica*, Zett.) and the parasite, *Mormoniella vitripennis*, Wlk.

The final part of the paper discusses experimental and natural diapause in various insects owing to cold, heat, dryness, humidity, food and inhalation of toxic gas and repercussions on the offspring of abnormal conditions affecting the parents. This concludes with a discussion of the hypotheses and theories of diapause put forward by various authors.

ROUBAUD (E.). **Les phénomènes d'inertie évolutive chez la mouche verte commune *Lucilia sericata* Meig. Fatigue évolutive cyclique.—Lignées fatigables et lignées infatigables.**—*Soc. ent. France, Livre du Centenaire*, pp. 213–224, 1 pl., 4 refs. Paris, 1932.

The author discusses investigations on the spontaneous diapause affecting the so-called hibernating larvae of *Lucilia sericata*, Mg., which belongs to the heterodynamic group of flies [*R.A.E.*, B, xi, 55]. Experiments were undertaken to determine whether the period of true diapause or asthenobiosis occurs regularly at fixed intervals, as in the case of *Mydaea platyptera*, Zett., in which there are two generations a year with the diapause occurring in the larvae of the second. The technique used to breed successive generations of flies is described. The adults were fed on sweetened condensed milk, and pieces of fresh beef spleen were provided for oviposition ; the larvae were reared in pulped spleen kept moist by a substratum of damp sawdust or sand. Both adults and larvae were kept at a temperature of 25–28°C. [77–82·4°F.]. Larvae ceased feeding about the 5th day, and pupae began to appear about the 7th day after egg deposition ; larvae that had not pupated by the 11th day were considered to be affected by the spontaneous retardation of development that characterises asthenobiosis. In this species the intensity of the asthenia is very variable and may take the form of a temporary prolongation of the prepupal stage for one or two days or of a persistent inertia that may be fatal unless terminated by appropriate stimuli.

Observations on the offspring of females caught in nature at different times of the year showed that it is towards the end of the active season of the fly that larvae affected by asthenobiosis are increasingly produced. Thus the larval asthenobiosis of *Lucilia* is part of a normal seasonal cycle, but the rearing of successive generations of flies under constant conditions of temperature proved that this is a physiological cycle independent of external environment. In three series of larvae reared through 7 generations, the percentage of larvae affected by asthenobiosis first increased and subsequently decreased to 0–0·8, but the occurrence of large numbers of asthenic larvae was not associated with any particular generation, for the second and third series were the progeny of asthenic larvae from the first series artificially reactivated by exposure to low temperatures, and in each case the first generation was composed entirely of active larvae. The gradual decrease in the numbers of asthenic larvae without the intervention of reactivating hibernation is thought to be due to natural selection, since the asthenic larvae in each generation undergo a period of more or less prolonged inactivity, and the production of further generations is therefore dependent on the active individuals in each generation. Thus a homodynamic race is produced from a heterodynamic one subject to cyclic fatigue.

It was also found that in a given generation the eggs laid earliest and therefore deposited by the most active individuals gave rise to the lowest percentages of asthenic individuals. It is considered unlikely that the suppression of cyclic fatigue that manifests itself about the 7th generation is permanent, and in the third of the series previously mentioned, which has now reached the 12th generation, there is a tendency for asthenia to reappear. Thus a definitely homodynamic race would only be produced after a long period in which the tendency to asthenia in each cycle of generations became less and less until it finally disappeared. It seems probable that such races are produced in nature in tropical countries in this species or its allies, which are therefore subject to poecilobiosis [*cf.* xx, 213].

RICHARDSON (H. H.). **An efficient Medium for rearing Houseflies throughout the Year.**—*Science*, lxxvi, no. 1972, pp. 350–351, 5 refs. New York, 14th October 1932.

A better medium for rearing *Musca domestica*, L., than a mixture of pig and horse manure [*R.A.E.*, B, xix, 197], one of the disadvantages of which is that a mite parasitic on the adult flies may be introduced with the horse manure, was obtained as the result of studies in Iowa. The mixture is made of 3¼ lb. wheat bran thoroughly mixed with 1¾ lb. lucerne meal to which is added 5,000 cc. water, 300 cc. yeast suspension, and 25 cc. diamalt, a product containing a high percentage of malt sugar. The yeast suspension is obtained from a stock prepared from baker's yeast (1 lb. to 2 U.S. gals. water), which is kept on ice and used as required. The quantity necessary could probably be considerably lessened by preparing the entire mixture one day before use, so that the yeast cells have time to multiply. Flies are attracted to and readily oviposit on the medium, and small amounts of it can be used in the breeding cages for obtaining eggs. These can then be added to a large quantity of the mixture for rearing the larvae, the jars containing it being incubated at 90°F. Fresh diluted milk appeared to be a satisfactory food for the adult flies. With this larval medium, large numbers of flies were successfully reared throughout the year.

SYMES (C. B.). **Notes on the Infectivity, Food and Breeding Waters of Anophelines in Kenya.**—*Rec. Med. Res. Lab. Kenya*, no. 4, 28 pp., 1 fldg. diag. Nairobi, 1932.

Adult Anophelines have been collected from representative collecting stations in Nairobi since May 1926. *Anopheles gambiae*, Giles (*costalis*, Theo.) and *A. funestus*, Giles, were taken chiefly in native dwellings, whereas the majority of the other species were collected from cattle sheds. Since the beginning of 1929, batches of living adults from native huts and cattle sheds have been obtained from Taveta and other districts. Numbers of these mosquitos were examined for malaria parasites, which were observed only in *A. gambiae* and *A. funestus*. In Nairobi, only *A. gambiae* was found to be infective ; the period of infection appears to extend from April to July inclusive. In Taveta, the period of infection is prolonged ; *A. funestus* showed a higher rate of infection during the relatively dry months, whereas the rates in *A. gambiae* were higher during and after the rains.

Precipitin tests to determine the nature of the blood meals of mosquitos caught in native huts, cattle sheds and other buildings were undertaken from 1926 until February 1932. Most of the tests with *A. gambiae* were against anti-human serum only, and 78 per cent. proved positive. In Taveta, where about 50 per cent. of the huts used as collecting stations are primarily cattle sheds (though they are shared by women) only 6 out of 165 individuals of *A. funestus* contained ox blood, whereas in Trans Nzoia, though cattle are not so easily accessible or so numerous in huts, the proportion showing ox blood was much higher. Further tests are required to ascertain whether *A. funestus* is definitely more attracted to man in Taveta than in the Trans Nzoia district. In one district a few individuals of *A. garnhami*, Edw., and in another large numbers of *A. pharoensis*, Theo., were found in native huts in which cattle were also housed, but both showed a decided preference for ox blood.

Investigations were also made on the pH values and the temperatures of water from various sources. Anopheline larvae occurred too infrequently to allow of any conclusions as to the limits of their pH tolerance, but they appear to tolerate practically the whole range of values recorded for natural waters in the Nairobi District, and it seems therefore that this factor is not an indication of the suitability of water for their development. From the figures obtained, there also appears to be nothing to suggest that temperature in itself plays any part in the restriction of Anopheline breeding. Observations on the association of Anopheline larvae with frogs, tadpoles and certain local fish indicate that they are not an efficient check on Anopheline production under present conditions. Details of all these investigations are shown in tables.

Wood (R. C.). **Tsetse Fly Report, 1930.**—*Ann. Med. Rep. Nyasaland Prot. 1930*, Appx. iv, pp. 47–50. Zomba, 1931.

Lamborn (W. A.). **Medical Entomologist's Report for 1931.**—*Ann. Med. Rep. Nyasaland Prot. 1931*, Appx. i, 20 pp. Zomba, 1932.

In 1928 large numbers of *Glossina morsitans*, Westw., migrated in a southerly and south-easterly direction, and the projected barrier-clearing running eastward from Fort Manning was crossed in so many places before deforestation was completed that it was abandoned. Arrangements were then made for the clearing and settlement of another barrier line running westward from Lilongwe ; it was estimated that the fly could not reach this line in less than 3 years. Investigations in 1929 on the spread of the fly south of the original line showed a few scattered individuals in a small area in the Dowa District and an infestation along about 4 miles of the main motor road from Fort Manning to Lilongwe ; elsewhere the advance seemed to have stopped, and the distribution was about the same as at the time clearing was abandoned. No flies were found south of the main road, and the clearing of a strip of dense forest ½ mile wide on the northern side, together with the formation of a barrier by the interlaced felled trees, which game did not succeed in crossing, resulted in the complete control of the fly, which has not since been reported on the road.

Many of the villages settled at the time of the original clearing had remained and their garden clearings had become extensive ; moreover, the opening of a tobacco buying station just south of the road and the demand for labour on large European holdings had resulted in further settlement and progressive clearing.

In 1930, the position was regarded as stationary, but further surveys in May and December 1931 showed that it was steadily improving ; no flies were taken in the vicinity of the main road, and a few only in the region south of the original line. Natives had been settled in the vicinity of the clearing on the main road, which was well maintained and has now been planted with maize. The continued demand for smoke-cured tobacco is producing the gradual deforestation of the area menaced by tsetse to meet the need for fuel.

The fly trap used in Zululand against *G. pallidipes*, Aust. [*R.A.E.*, B, xix, 78] proved of little value against *G. morsitans* in Nyasaland, probably owing to the fact that the latter attacks the flanks of an animal rather than the under side. However, other models designed to admit flies at the sides also proved unsatisfactory.

Further information on the bionomics of various Tabanids is given [xviii, 262]. Investigations on the possibility of the cyclical transmission of trypanosomes of animals by vectors other than *Glossina* were continued [*loc. cit.*], but negative results were obtained with Tabanids and *Stomoxys calcitrans*, L. The larvae of *Tabanus africanus*, Gray, and mosquitos, particularly *Mansonia* (*Mansonioides*), are associated with water lettuce (*Pistia stratiotes*), and as this plant is used as food for pigs in China and Malaya, investigations were undertaken to determine if it could be utilised for this purpose in Africa. Native pigs consumed it readily once they had become accustomed to it, and it is suggested that encouraging natives to keep pigs on this diet might bring about a certain amount of control of these insects.

PANTAZIS (G.). **Ratten und Rattenflöhe der Stadt Athen.** [Rats and Rat-fleas of the City of Athens.] [*In Greek.*]—*Prakt. Acad. Athènes*, vii, pp. 96–100, 2 figs. Athens, 1932. (With a Summary in German.)

The following is taken from the author's summary : During a survey in various parts of Athens in the winter of 1930–31, 2,197 rats were examined and 11,563 fleas collected. The rats were chiefly *Mus* (*Rattus*) *norvegicus*, the only other species being *M.* (*R.*) *rattus alexandrinus*. None was found to harbour plague bacilli, but 3 per cent. were infected with *Trypanosoma lewisi* and 17 per cent. with the Cestode, *Hymenolepis diminuta*. Of the fleas, 9,755 were *Xenopsylla cheopis*, Roths., 1,445 *Leptopsylla segnis*, Schönh. (*musculi*, Dug.), 317 *Ceratophyllus fasciatus*, Bosc, 40 *Ctenocephalides* (*Ctenocephalus*) *felis*, Bch., 5 *C.* (*C.*) *canis*, Curt., and only one *Pulex irritans*, L. The ratio of females to males was 63 : 37, and the average flea index was 5·26, the maximum number of fleas taken on a rat being 171. The number of fleas on the animals was in inverse proportion to the relative humidity. *T. lewisi* occurred in 252 fleas.

PANTAZIS (G.). **Die Culicinenfauna Griechenlands.** [The Culicid Fauna of Greece.] [*In Greek.*]—*Prakt. Acad. Athènes*, vii, pp. 170–176, 6 refs. Athens, 1932. (With a Summary in German.)

A list is given of 37 species of mosquitos found in various parts of Greece, with brief notes on their distribution and ecology, the following Anophelines being included : *Anopheles algeriensis*, Theo., *A. bifurcatus*, L., *A. sacharovi*, Favr (*elutus*, Edw.), *A. hyrcanus*, Pall., *A. maculipennis*, Mg., *A. plumbeus*, Steph., *A. superpictus*, Grassi, and *A. italicus*, Raff.

PANAGIA (A.). **Esperienze ed osservazioni sulla delarvizzazione anofelica nella profilassi malaria.** [Experiments and Observations on Work against Anopheline Larvae in Malaria Prophylaxis.] —*Riv. Malariol.*, xi, no. 4, pp. 453–467. Rome, 1932. (With Summaries in Italian p. 545, French p. 547, English p. 549, German p. 551.)

Notes are given on the results of tests of the action of a variety of substances on Anopheline larvae, but the author concludes that in practice none of them would give results in control comparable with those obtainable with *Gambusia holbrooki*, Paris green, and oiling. Experiments by Dr. W. Mundula in the author's laboratory in Rome showed that if large numbers of larvae were available, *G. holbrooki* would devour so many that their digestion entailed a prolonged fast during which other larvae developed undisturbed. This drawback could be remedied by regulating the proportion of fish to larvae. In water poor in vegetation *G. holbrooki* was found capable of destroying 60–80 per cent. or more of the larvae. The fact that Paris green attracts Anopheline larvae by its colour was demonstrated by dusting with inert coloured earths ranging from blue to green, such dusts being eagerly swallowed by the larvae. In an area in which road dust was not available, talc was found to be a satisfactory carrier for Paris green ; it mixed perfectly and floated for 8 days on stagnant water. The fact that it is obtainable ready for immediate use offsets its higher initial cost as compared with road dust.

CAPOGROSSI GUARNA (F.). **Un centro industriale sorto in zona malarica.** [An industrial Centre established in a malarious Area.]—*Riv. Malariol.*, xi, no. 4, pp. 493–506, 3 figs., 2 graphs, 1 map. Rome, 1932. (With Summaries in Italian p. 546, French p. 548, English p. 550, German p. 552.)

Various anti-malarial measures, including the use of aluminium gauze screens, oiling and treatment with quinine were carried out at a factory centre newly established near Civitavecchia in an extremely malarious zone. The resident population was 400 and the fluctuating population averaged 1,112. Of the Anophelines, *Anopheles maculipennis*, Mg., was predominant, *A. bifurcatus*, L., appearing in small numbers late in the season, and *A. superpictus*, Grassi, being very rare. Only 54 cases of malaria occurred, of which 37 were certainly relapses.

RAFFAELE (G.). **Chiavi dicotomiche degli anofelini italiani.** [Dichotomic Keys to the Italian Anophelines.]—*Riv. Malariol.*, xi, no. 4, pp. 507–509, 6 refs. Rome, 1932. (With Summaries in Italian p. 546, French p. 548, English p. 550, German p. 552.)

Keys are given to the adult females and 4th stage larvae of *Anopheles sacharovi*, Favr (*elutus*, Edw.), *A. maculipennis*, Mg., *A. plumbeus*, Steph., *A. italicus*, Raff., *A. hyrcanus* var. *pseudopictus*, Grassi, and *A. superpictus*, Grassi. The larvae of *A. sacharovi* and *A. maculipennis* cannot be differentiated.

MAURICE (A.). [**The Employment of a Rodent in anti-malarial Work.**] —*Avenir méd.*, July-August 1931. (Abstract in *Riv. Malariol.*, xi, no. 4, pp. 535–536. Rome, 1932.)

The Chilean beaver [*Myopotamus*], which feeds on aquatic plants, only eating others when these are lacking, clears away the aquatic grasses in which mosquito larvae are protected from fish and other enemies. Its skin and flesh are of value, and as it has proved to be easily domesticated in France, its establishment in marshy areas is advocated.

APFELBECK (V.). **Zur Biologie der in Jugoslavien beobachteten dendrolimnokolen Stechmücken (Culicidae).** [On the Biology of Mosquitos breeding in Water in Tree Holes as observed in Jugoslavia.] —*Acta Soc. ent. jugoslav.*, v-vi (1930–1931), fasc. 1–2, pp. 49–61, 9 refs. Belgrade [1932]. (With a Summary in Serbian.)

Brief notes are given on the distribution and biology of 7 species of mosquitos, including *Anopheles plumbeus*, Steph., found in different parts of Jugoslavia since November 1926 breeding in hollows in trees. The ecological conditions under which each species occurred are briefly discussed.

TRAUSMILLER (O.). **Ueber die Grenzen der Malariabekämpfung mittels Gambusien.** [On the Limits of Malaria Control by Means of *Gambusia holbrooki*.]—*Arch. Schiffs- u. Tropenhyg.*, xxxvi, no. 10, pp. 530–539, 4 figs., 19 refs. Leipzig, October 1932.

This paper describes the successful control by *Gambusia holbrooki* of Anopheline larvae in two Jugoslavian islands in the Adriatic where the larvae chiefly occur in rain-water ponds used for watering cattle. On one island, following the original importation of 200 individuals in August 1924, the fish became established everywhere, surviving the abnormally severe winter of 1929–30. As a result, Anopheline larvae became rare, and the incidence of malaria was greatly decreased. At the beginning of the work, the ponds were kept clear of vegetation, but this was subsequently found to be unnecessary, the fish multiplying to such an extent that they penetrated even the densest vegetation in search of food. On the other island, in which malaria was rife in places, *G. holbrooki* was introduced in 1927, and by 1929 larvae were scarce in the ponds, where no attempt to clear the vegetation had been made, and in a small coastal lake containing brackish water that had been a most prolific breeding-place. The adult mosquitos disappeared from villages, and acute cases of malaria no longer occurred.

[KALANDADZE (L.) & MCHELIDZE (I.).] KALANDADSE (L.) & MTSCHEDLIDSE (J.). **Materialien zur Biologie des Fisches** *Gambusia.* [Data on the Biology of *Gambusia.*]—*Arch. Schiffs- u. Tropenhyg.*, xxxvi, no. 10, pp. 539–544. Leipzig, October 1932.

The information given here is substantially the same as in a previous paper by these authors [*R.A.E.*, B, xix, 26] except that it is now stated that *Gambusia* can develop normally in water containing iron oxide.

UHLMANN (E.). **Zur Gradation von** *Chloropisca notata* **Mg.** [Swarming of *C. notata.*]—*4. Wanderversamml. deuts. Ent. Kiel (11.–15. vi. 1930)*, pp. 70–76, 14 refs. Berlin, December 1930.

A list is given of recorded instances of swarming of *Chloropisca notata*, Mg., and other Chloropids in Central Europe, chiefly in Germany, from 1812 to 1930, with notes on cases observed by the author [*cf. R.A.E.*, B, xviii, 241, etc.].

MACLEOD (J.) & GORDON (W. S.). **Studies in Louping-ill (An Encephalomyelitis of Sheep). II. Transmission by the Sheep Tick,** *Ixodes ricinus* **L.**—*J. Comp. Path.*, xlv, pt. 3. pp. 240–256, 5 graphs, 7 refs. Croydon, September 1932.

An account is given of further experiments in Scotland [*cf. R.A.E.*, B, xx, 206] on the transmission of louping-ill of sheep by *Ixodes ricinus*, L. The virus of louping-ill was recovered from ticks engorged on an infected sheep during the period of thermal reaction. Moreover, the presence of virus acquired by the larvae was demonstrated in the succeeding nymphal stage. The criteria used to determine infection with louping-ill were the development in sheep of a febrile reaction that may or may not be followed by symptoms of nervous disturbance and by death, the production of symptoms of louping-ill followed by death in mice inoculated intracerebrally with the blood of the reacting sheep taken at the peak of the thermal reaction (mice do not react to " tick-borne fever " [*loc. cit.*]), and immunity of sheep that have recovered when inoculated intracerebrally with the virus. Louping-ill was produced in 9 cases in which sheep were infested with infected ticks ; 6 of these cases were infected with tick-borne fever either before or at the time of exposure to louping-ill infection. It appears from the results that infection of the central nervous system occurred only in sheep that were suffering from a concurrent infection with tick-borne fever, and it is possible that the latter disease facilitates the invasion of the central nervous system by the louping-ill virus. It has been shown, however, that sheep can become infected with (and even die from) louping-ill infection transmitted by ticks, when tick-borne fever is not present.

Thus there is little doubt that *Ixodes ricinus* is the vector of louping-ill in nature, and it is probable that, at least in the majority of infections, tick-borne fever plays some part in establishing the disease. Ticks were found to be capable of producing louping-ill within 12 days after moulting, and as they require 8–9 days to harden before attaching themselves, it follows that they are probably infective as soon as they attack their host. There is considerable difficulty in producing louping-ill experimentally unless the infective material be introduced directly into the central nervous system, and it is therefore interesting that the tick can cause infection of the central nervous system by inoculating the virus into the peripheral blood stream. The type of reaction in a sheep infected by tick-bite is described.

DE VERTEUIL (E.). **Malaria Survey.**—*Counc. Pap. Legis. Counc. Trinidad & Tobago*, no. 97 of 1931, 32 pp., 5 maps, 2 diags., 26 refs. Port of Spain, 1931. Price 2*s*. 3*d*. [Recd. October 1932.]

This is a detailed report of an anti-malaria survey of a selected area in western Trinidad, including Port of Spain, carried out from October 1930 to September 1931. The area was re-surveyed each month, and the greater part of the scientific data collected will be applicable to the Island as a whole. Only three species of *Anopheles* were found, *A. tarsimaculatus*, Goeldi, and *A. albitarsis*, Arrib., which are well-known malaria vectors, and *A. neomaculipalpus*, Curry [*R.A.E.*, B, xix, 141]. The breeding-places may be divided into three main types, tidal lands, including mangrove swamps and coconut plantations on the coast, rivers and streams flowing from the hills of the Northern Range, and rice-fields and swamps. *A. tarsimaculatus*, which has a decided preference for brackish water, is the only Anopheline found in the tidal lands. These lands may be dealt with by filling, which is the best but most expensive measure, by confining the fresh water in channels and preventing it from mixing with the sea water to form brackish swamps, or by flooding the area with sufficient (85 per cent. or more) sea water to maintain the salinity, and so prevent breeding. No breeding takes place in mangrove swamps in which there is a free circulation of sea water or in those on comparatively high ground, which are usually dry except when salt water is supplied by spring tides, or fresh water by rain floods. On the other hand, in swamps where the salinity of the sea water is lowered during the rainy season by fresh flood water, prolific breeding takes place.

During the rainy season, there is no Anopheline breeding in the upper part of the rivers where the current is good and there is constant flushing through open channels, but in the lower reaches the course is blocked by numerous temporary devices and the flood water is carried to the rice-fields and swamps, in which all the three species of Anophelines breed. In many sections, continuous blocking for a number of years has resulted in the almost complete disappearance of the river bed, and in all cases the rivers gradually flatten out and silt up. During the dry season, the current becomes sluggish and breeding occurs in the stagnant pools formed in the river beds by natural obstructions such as tree-trunks, etc. Moreover, in some cases, concrete dams have been erected to conserve water, and breeding takes place in the stagnant water above them and in irrigation water in vegetable gardens and water-cress beds.

A high malarial incidence and mortality is associated with rice-growing areas throughout the Island, and it is probable that the resident population of the areas surveyed infect large numbers of mosquitos. During July and August, adult Anophelines, particularly *A. tarsimaculatus*, migrated in large numbers and were found at distances of 2–2½ miles from their breeding-places in the rice-fields and swamps. The migrating females of *A. tarsimaculatus* will attack at all hours, even in direct sunlight near shady places. No males were taken, and it therefore appears that fertilisation takes place before migration.

Oöcysts were found in 4 out of 80 females of *A. tarsimaculatus* dissected between November 1930 and July 1931, and in 1928, 3 out of 200 caught in or near dwellings had shown sporozoites in the salivary glands. The successful results of measures directed against the breeding-places of this species over a number of years and the prevalence of malaria in the coastal areas where brackish water exists indicate that this Anopheline is the most important vector of malaria in Trinidad. With the exception of polluted or running water, it will breed in almost any collection of water, small or large, fresh or salt, but prefers water-holding débris, such as dead coconut fronds, mangrove bark, rotten wood, etc. During the dry season, the breeding-places of *A.* [*albitarsis*] were confined to the grassy banks of clear, running streams, and clear spring water in seepage areas such as cress beds, but in the rainy season it is commonly found in rice-fields. *A. neomaculipalpus* was found in the dry season in a slow stream of clear water, in seepage water, in isolated muddy pools and in the bed of a stream ; in the rainy season it occurred in rice-fields.

It is pointed out that Roubaud's theory of cyclic fatigue [xix, 187] may afford an explanation of various obscure points connected with the Anopheline problem in Trinidad. Both local and long distance control measures are discussed, and the application of the latter to prevent the migration of Anophelines from distant swamps to the suburbs and even to the city of Port of Spain itself is advised.

Van Volkenberg (H. L.). **Report of the Parasitologist.**—*Rep. Porto Rico Agric. Expt. Sta. Mayaquez 1931*, pp. 24–27, 1 fig. Washington, D.C., May 1932.

Brief notes are given on the more usual Arthropods attacking animals in Porto Rico, including the horn-fly [*Haematobia irritans*, L.], which is a most serious pest of cattle, particularly in the dry regions, and is found throughout the Island except at the higher elevations ; the stable-fly [*Stomoxys calcitrans*, L.], which thrives throughout the year and is frequently more common in houses in the country than the house-fly [*Musca domestica*, L.] ; the ox warble [*Hypoderma*], larvae of which are seen every year on imported cattle although it appears unable to establish itself ; Tabanids, of which *Chrysops costata*, F. (deer fly) is the one most commonly found on horses ; and *Tunga penetrans*, L. (sand flea), which attacks pigs and man. Fleas, particularly dog fleas [*Ctenocephalides canis*, Curt.], are the only parasites, external or internal, that have so far been definitely reported from the mongoose. The Hydrophilid, *Tropisternus collaris*, F., is apparently an important intermediate host in Porto Rico of *Macracanthorhynchus hirudinaceus* (thorny-headed worm), a parasite of pigs. The pigs often feed on the roots of water plants in swamps and thus have an opportunity of swallowing the beetles, which become sluggish after infestation.

Conferencia Sanitaria Nacional de 1931. [The Venezuelan National Sanitary Conference of 1931.]—Roy. 4to, 691 pp., maps, illust. Caracas, Minist. Salub. Agric. Cria Venezuela, 1932.

At this conference, which was held in December and was the second of an annual series, all the reports dealt with malaria, which had been studied throughout Venezuela during the year according to a general plan. Very little attention is devoted to mosquitos, but some records of their occurrence in the various districts are included.

RAYNAL (J.). **Note sur le paludisme d'altitude.**—*Marseille méd.*, lxix, no. 6, pp. 245–260, 4 figs. Marseilles, 25th February 1932.

In Guatemala, malaria, which was at one time confined to the low coastal regions, has of recent years invaded the plateaux and high valleys between about 5,000 and 6,500 feet above sea level. In the high regions, *Anopheles pseudopunctipennis*, Theo., is the only Anopheline found, whereas in the low ones it is absent and *A. argyritarsis*, R.-D., and *A. albimanus*, Wied., are most prevalent. Blood examinations show that on the coast infections with *Plasmodium falciparum* (*praecox*) equal or exceed those with *P. vivax*, whereas at higher altitudes *P. vivax* predominates almost to the exclusion of *P. falciparum*, which appears to occur only in workers that have spent some time previously in the coastal districts.

From this concrete example, the author proceeds to discuss various aspects of the problem of malaria at high altitudes and particularly the possible causes for the predominance of *P. vivax*.

KUMM (H. W.) & FROBISHER (M.). **Attempts to transmit Yellow Fever with certain Brazilian Mosquitoes (Culicidae) and with Bedbugs** (*Cimex hemipterus*).—*Amer. J. Trop. Med.*, xii, no. 5, pp. 349–361, 14 refs. Baltimore, Md., September 1932.

As *Mansonia titillans*, Wlk., is much more common and more widely distributed in tropical and subtropical America than the species of this genus used in experiments by Dyar and Shannon [*R.A.E.*, B, xx, 10], attempts were made to determine whether this species, which feeds readily on man, can transmit yellow fever to monkeys [*Macacus rhesus*]. Negative results were obtained in 8 experiments in which 1–15 individuals were fed on normal monkeys 11–30 days after feeding on infected ones. On the other hand positive results were obtained in experiments in which 1–10 individuals of *M. titillans* were injected into normal monkeys 14–30 days after the infective feed. In experiments with other mosquitos, *Culex corniger*, Theo., *C. coronator*, D. & K., and *C. surinamensis*, Dyar, could not be induced to feed on man or monkeys during the day or night. *Trichoprosopon* (*Joblotia*) *digitatum*, Rond., did not feed readily on monkeys, and few survived in captivity. Two individuals known to have engorged on infected monkeys 17 and 20 days previously were injected into normal monkeys with negative results. *Haemagogus janthinomys*, Dyar, fed on man and monkeys, but as it did not survive long enough in captivity, the experiments could not be completed.

Bed-bugs (*Cimex hemiptera*, F.) fed on infected monkeys produced the disease when injected 1–2 days after the infective feed, but failed to do so when injected after longer periods. Two normal monkeys bitten by 9 and 6 bed-bugs fed respectively 4 and 12 days previously on infected monkeys were also injected with the faeces of the bugs collected since the infective meals, but did not become infected. It would appear that bed-bugs are not important vectors of yellow fever, although it is possible that a bug might bite an infected person and be crushed within 24 hours on the skin of a normal susceptible individual, thus producing infection. The results of these experiments do not confirm those of Monteiro [xviii, 165 ; xx, 166].

Mosquito Investigations.—*Rep. New Jersey Agric. Expt. Sta. 1930–31*, pp. 139–182. New Brunswick, N.J., 1932.

An account is given of the work done in controlling mosquitos in New Jersey during 1930–31, much of which has previously been noticed [*R.A.E.*, B, xx, 52, 53, 176, 241]. Additional papers include one by T. J. Headlee giving a description of a machine for cutting ditches in salt marshes, and another by F. W. Miller on the egg-laying habits of *Aëdes vexans*, Mg. (*sylvestris*, Theo.), which shows that from eggs deposited in 1928, 3 larvae hatched in 3 days in 1931 on the addition of water, and that this mosquito has no preference for any particular type of breeding-place.

Botsford (R. C.). **Mosquito Control in Connecticut, 1931.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 338, pp. 580–582. New Haven, Conn., May 1932.

Details are given on mosquito control work in Connecticut during 1931, which consisted chiefly of work on drainage and ditches in salt marshes. A pyrethrum-kerosene larvicide was found satisfactory in breeding-places where oil was objectionable, but it is not thought probable that it will replace the latter as a general killing agent.

McDaniel (E. I.). **Flies and Mosquitoes commonly found about Michigan Homes.**—*Circ. Michigan Agric. Expt. Sta.*, no. 144, 27 pp., 5 figs. East Lansing, Mich., August 1932.

A somewhat popular account is given of the more common flies and mosquitos that may occur in dwellings in Michigan, with notes on their control. In order to facilitate the recognition and control of different types of mosquitos, information on the adult activity and breeding-places of various species is summarised in a table.

Dove (W. E.), Hall (D. G.) & Hull (J. B.). **The Salt Marsh Sand Fly Problem** (*Culicoides*).—*Ann. Ent. Soc. Amer.*, xxv, no. 3, pp. 505–522, 3 pls., 2 figs., 7 refs. Columbus, Ohio, September 1932.

The various species of *Culicoides* occurring in the salt marshes and brackish water areas on the Atlantic and Gulf Coast littorals of the United States are extremely annoying to man, and as attempts during recent years to develop these regions as holiday resorts have been largely prevented by their activity, they have become of considerable economic importance.

Different species occur at different seasons, but all are most troublesome when there is no breeze. In the more northern localities they disappear during the winter months, but in subtropical areas they may be present throughout the year. They attack during the day as well as at night and are capable of penetrating through very fine mesh screens. Localities near fresh water inlets and streams leading to them are attractive sites for residences and hotels, and it is in these localities that the midges are most prevalent.

Descriptions are given of the cages placed over possible breeding-places to catch adults and of the method used to recover larvae from soil samples. No larvae were obtained from marshes affected by daily tides. Shady places were found to be most favourable for breeding. In the open marshes more larvae were obtained from crab holes in the short salt-marsh vegetation affected only by the action of unusually high tides or rainfall than from those among tall grasses in these areas. The salt content of random samples was found to vary from 1,500 parts in 100,000 of water to more than that found in sea water. Observations on pH values suggest that the larvae are favoured by acidity. An increase in the numbers of larvae found after flooding by rain or tides was attributed to dispersion from densely shaded areas. Drainage ditches do not appear to be primary breeding-places of large numbers of *Culicoides*, but apparently collect larvae washed from other situations. Holes in them dug by fiddler crabs collect water and are favourable to the larvae.

In the laboratory the only medium in which the midges could be reared to maturity was decaying grass roots and humus in brackish water. Larvae taken in South Carolina more than half-grown continued their development for periods varying from 4 to 6½ months at cool temperatures (about 50°F.), but lived for only a few weeks at summer temperatures (about 90°F.). When exposed to direct sunlight, they died within a few minutes. Thus cool temperatures appear to be favourable. Observations suggest that the larval period may occupy more than 6 months, but the pupal period lasts only 4–7 days. Under laboratory conditions the adults lived about 10 days, but since they require 3–4 blood meals before they deposit eggs, the maximum longevity in nature is undoubtedly longer.

In late autumn and late spring, concentrations of larvae of various sizes are found in decaying vegetation in shaded areas, and the possibility of controlling them at these times by the drying of the humus or by spraying with an insecticide was investigated. The drying out of the breeding-places was found to destroy the larvae, and the use of drainage or the cutting or trimming of trees on the edges of marshes is suggested. In the laboratory the larvae were killed by contact insecticides soluble in salt water, but Paris green and oil films had no visible effect. A waste product extracted when pine timber undergoes vacuum treatment with coal tar creosote oil was found to be toxic. It consists of water and pine sap with a small amount of creosote oil, and is obtained from a catch basin used for the recovery of the creosote after the latter settles to the bottom. It gave a complete and immediate kill at dilutions of 1 : 1,500 and a complete kill in 2 hours at 1 : 2,500. A mixture of 1 part of crude carbolic acid with 19 parts of this product gave a complete kill at dilutions of 1 : 10,000 parts salt water. Against mosquito larvae it was effective at much greater dilutions. Tests on salt marshes showing concentrations of *Culicoides* larvae, using 50 U.S. gals. of the phenolised product to 12,000 sq. ft., gave promising results. Creosoted pine sap without the addition of phenols may prove to be of value against other Arthropods, such as fleas, mites, etc.

Bloodsucking and non-bloodsucking Flies in Relation to Human Welfare.—*Ann. Ent. Soc. Amer.*, xxv, no. 3, pp. 603–630, 20 refs. Columbus, Ohio, September 1932.

The following papers, Bloodsucking Flies (exclusive of CULICIDAE) in Relation to Human Welfare, by H. H. Schwardt, Mosquitoes in Relation to Human Welfare, by E. H. Hinman, and Non-bloodsucking Flies as Vectors of Pathogenic Micro-organisms, by W. B. Herms, were read before the 26th meeting of the Entomological Society of America and consist of a review of the literature on their respective subjects. A few additional notes are given in a discussion of them by E. C. Faust.

BRADT (S.). **Notes on Puerto Rican Black Flies.**—*P. R. J. Publ. Hlth. Trop. Med.*, viii, no. 1, pp. 69–81, 2 pls., 14 refs. San Juan, P.R., September 1932. (With a Summary in Spanish.)

The three species of Simuliids recorded from Porto Rico are *Simulium amazonicum*, Goeldi (*minusculum*, Lutz), *S. haematopotum*, Malloch, and *S. quadrivittatum*, Lw. The observations on the habits of these flies reported in this paper were made from the middle of March to the middle of May, 1932, chiefly on the last-named species. Attempts to rear the larvae in the laboratory were mainly unsuccessful ; only 15 per cent. of the 400 larvae used pupated, the majority dying within a few days of their introduction into the containers. By means of a partial vacuum a stream of air bubbles was passed through the container. Various types of food were tried, including green algae and certain yeast products. The duration of the entire larval period was not determined, but it was estimated from the moulting of a large number of individuals of various sizes to last 17–21 days. In rearing pupae, the best results were obtained when they were placed on gauze in small vials with just enough water to keep them damp. Under these conditions the pupal stage occupied 84–121 hours at 30°C. [86°F.]. Characters by which the larva and pupa of *S. quadrivittatum* may be distinguished are illustrated.

In Porto Rico, Simuliids prefer to attach themselves to plant matter rather than to stones, and it is suggested that, where possible, streams should be cleaned and then treated with at least two applications of a suitable larvicide at intervals of 10 days. An emulsion of 10 parts by volume carbon bisulphide, 1 part cold-water-soluble resin fish-oil soap and 3 parts water was the most satisfactory in the laboratory and diluted to 1 : 3,000 caused the death of the larvae in a short time. When a litre of this emulsion was poured into a stream with an approximate capacity of 0·7 cu. m. per second, no dead larvae were collected in a net about 44 yds. downstream half an hour later, but next day the number of larvae in this stretch was reduced by 80 per cent. This may be explained by the fact, observed in the laboratory, that larvae after death frequently remain attached until decomposition begins.

Rocky Mountain Tick carries Anaplasmosis.—*Off. Rec. U. S. Dept. Agric.*, xi, no. 9, pp. 53, 59. Washington, D.C., 27th February 1932.

Dermacentor venustus, Banks (*andersoni*, Stiles) has been found by C. Rees to transmit anaplasmosis of cattle in the United States. This tick is distributed throughout the Rocky Mountain and West Coast States, a region where anaplasmosis is known to occur, but from which there are no records of *Boophilus annulatus*, Say, *Rhipicephalus sanguineus*, Latr., or *Dermacentor variabilis*, Say, the ticks previously found capable of transmitting the disease [*R.A.E.*, B, xviii, 101 ; xix, 66 ; xx, 136].

KLEINE (F. K.) & KRAUSE (M.). **Zur Uebertragung der Rückfallfieberspirochäten durch Zecken.** [On the Transmission of Relapsing Fever Spirochaetes by Ticks.]—*Arch. Schiffs- u. Tropenhyg.*, xxxvi, no. 11, pp. 587–589. Leipzig, 1932.

In the course of various experiments with *Ornithodorus moubata*, Murr., two instances were observed in which ticks infected in the adult stage transmitted the infection by subsequent feeding [*cf. R.A.E.*, B, xix, 18].

DJAPARIDSE (P. S.). *Stegomyia fasciata* (=*Aëdes argenteus*) **in Kutais.**—*Arch. Schiffs- u. Tropenhyg.*, xxxvi, no. 11, pp. 608–609. Leipzig, 1932.

In September 1929 and again in September 1930 the author found adults and larvae of *Aëdes argenteus*, Poir., in a town in western Georgia about 66 miles from the nearest harbour on the Black Sea.

TATE (P.) & VINCENT (M.). **Susceptibility of English** *Culex pipiens* **L. to Infection with Bird Malaria.**—*Nature*, cxxx, no. 3286, p. 630, 1 ref. London, 22nd October 1932.

The method of inducing females of *Culex pipiens*, L., to feed on canaries by exposure to light [*R.A.E.*, B, xx, 230] was utilised in transmission and infection experiments with bird malaria. Of mosquitos fed on birds heavily infected with *Plasmodium praecox* (*relictum*), 55 per cent. were found to be infected. On dissection many mosquitos showed more than 20 cysts on the stomach, and the salivary glands were heavily infected with sporozoites. The mosquitos readily transmitted the malaria parasite to healthy canaries. It is interesting that once the experimental difficulties of breeding and feeding *C. pipiens* of English origin are overcome, it behaves as a normal vector of bird malaria.

MACLEOD (J.). **The Bionomics of** *Ixodes ricinus* **L., the "Sheep Tick" of Scotland.**—*Parasitology*, xxiv, no. 3, pp. 382–400, 1 map, 4 charts, 14 refs. Cambridge, October 1932.

In connection with an investigation in Edinburgh to examine the possibility of controlling *Ixodes ricinus*, L., which is a major pest of farm stock in Britain and attacks sheep in the hill districts of Scotland, depreciating the quality and quantity of the fleece, a detailed study of its bionomics was made. Recent investigations have shown that it transmits louping-ill and "tick-borne fever" of sheep [*R.A.E.*, B, xx, 206, 266]. Under laboratory conditions at 60–70°F., the pre-oviposition period lasted 15–22 days, and eggs began to hatch after about 4 weeks. At 50–60°F., eggs began to hatch only after 37 weeks. Unfed larvae placed on a hedgehog generally dropped off gorged in 88–120 hours, the shortest feeding period being 67½ hours. Larvae gorged on sheep in 65 hours. Nymphs emerged in the laboratory after 6–7 weeks from larvae gorged in August, and after 28–37 weeks from those gorged in September or October. Unfed nymphs gorged in 4–7 days, with an average of 5. Nymphs gorged on sheep in spring and summer and kept in the laboratory at 60–70°F. became adult after 10–19 weeks. Females gorged on sheep in 7–11 days, the majority in 8–9. The sex ratio in nymphs emerging in the laboratory was about 5 males to 9 females. Unfed males and females survived for 21 months (one male for 31 months). The larvae survived for 2 years; some were able to feed after fasting for 15 months, and nymphs after fasting for 13 months.

In addition to the sheep, which is the chief host in Scotland, *I. ricinus* in one or more of its stages had been found on horses, dogs, and a number of wild mammals and birds. Blackface sheep became more heavily infested than Cheviot sheep on the same pastures, and ewes with lamb appear to be more liable to infestation. Non-acclimatised, experimental sheep exposed on a tick-infested farm were at first heavily infested and rapidly lost condition, but they subsequently began to recover and the average infestations on them and the native stock was approximately the same.

Reports on the distribution of *I. ricinus* in various districts in Scotland are recorded. Its seasonal prevalence was studied during a period of 15 months by counts of the numbers of ticks on representative samples at fortnightly or monthly intervals. The ticks appeared on sheep early in March and became increasingly numerous during April and May. In June the numbers began to decrease and steadily diminished until late August when a slight increase occurred. This was of short duration, and by the middle of November no ticks were found on sheep. The same periodicity was observed in the following spring and summer. An occasional tick was found on sheep in mild warm weather during the winter. Adults first appeared early in March, nymphs by the middle of March, and larvae were apparently most numerous in May and June. The seasonal incidence of *I. ricinus* on sheep in 1930 bore no apparent relation to rainfall.

A comparison of variations in weekly air temperature for 1930–1931 indicates that the ticks infest sheep in the greatest numbers at 45–60°F., the lower and higher critical temperatures for tick activity in nature being 40–45°F. and 60–70°F. respectively. No evidence of parasitism has been found in over 1,000 gorged nymphs or in many larvae collected in the field and bred out in the laboratory. The Encyrtid, *Ixodiphagus caucurtei*, du Buysson, has been found parasitising the nymphs in France, but has not yet been observed in Britain.

TAYLOR (A. W.). **The Development of West African Strains of** *Trypanosoma gambiense* **in** *Glossina tachinoides* **under normal Laboratory Conditions, and at raised Temperatures.**—*Parasitology*, xxiv, no. 3, pp. 401–418, 1 pl., 23 refs. Cambridge, October 1932.

The infectivity to *Glossina tachinoides*, Westw., of a representative selection of West African strains of *Trypansoma gambiense* has been studied with the particular object of determining whether non-transmissible strains occur there as frequently as they appear to do in East Africa. Investigation was at the same time continued into possible factors influencing the infestation rate of this trypanosome in *Glossina*, since it seemed not impossible that some factor necessary for normal development of the *brucei* group of trypanosomes in tsetse-flies had been absent in the transmission experiments carried out hitherto in African laboratories [*R.A.E.*, B, xvii, 41, 60 ; xviii, 172 ; xix, 65, etc.].

The following is taken from the author's summary : The development of strains of *Trypanosoma gambiense* in *Glossina tachinoides* is described. Complete development with infection of salivary glands and hypopharynx occupies from 12 to 40 days and upwards, according to the strain of trypanosome and the temperature.

An account is given of the infectivity to *G. tachinoides* of 26 strains of *T. gambiense* from epidemic and endemic sleeping-sickness areas in Northern Nigeria. None of these strains proved to be non-transmissible, and 25 of them gave total infectivity rates in the tsetse of from 0·9 to 10·5 per cent., the cyclical developmental rates ranging from 0·6 to 9·8 per cent. No evidence has been obtained that strains of *T. gambiense* from chronic cases of human trypanosomiasis in endemic areas are less transmissible by tsetse than strains originating in epidemic areas. Experiments are described in which *G. tachinoides* infected with *T. gambiense* was exposed to 37°C. [98·6°F.] for varying lengths of time. The effect of high temperature during the infecting period is seen in a marked and constant increase in the proportion of tsetse infected. In the case of one strain, a total infection rate of 77·8 per cent. was obtained with true cyclical development in 73·5 per cent.

It is suggested that the temperatures at which experimental tsetse are infected in the laboratory with *T. gambiense* are excessively low, and an investigation is to be made into the optimum climatic conditions for development of the trypanosome in the fly, with a parallel attempt to correlate this with the climatic conditions under which wild tsetse become infected in nature.

ANDERSON (D.). **Notes on Mosquito-borne Diseases in Southern Nigeria : III. Differences in the Periodicity of various Mosquitoes.**—*J. Trop. Med. Hyg.*, xxxv, no. 20, pp. 305–308, 7 graphs. London, 15th October 1932.

The seasonal prevalence of adults of *Anopheles gambiae*, Giles (*costalis*, Theo.), *A. funestus*, Giles, *A. hargreavesi*, Evans, *A. nili*, Theo., and various species of *Aëdes* and *Culex* was determined from data obtained daily from October 1930 to October 1931 from four different collecting stations in Abeokuta and compared with rainfall for the same period. Each station represented a different set of conditions, so that the sum of the four was taken to represent the average mosquito situation in Abeokuta. The variation in the numbers of *A. gambiae* corresponds to the rainfall curve with a lag of a few weeks. Breeding reached its maximum within 2 months after the onset of the rainy season and then diminished slowly to its minimum in January. The fact that the intensity of breeding does not continue to increase with the rains is usually explained by the violence of the downpour washing away the eggs and larvae in the streams. The occurrence of the main increase in the numbers of *A. nili* in August and September is probably due to the fact that this species breeds in water under very long grass and the grass only begins to attain the necessary length about this time of year. The curves for *A. hargreavesi* and *A. funestus* cannot be explained by what is known of their habits.

WILSON (C. J.). **Federated Malay States. Annual Report of the Malaria Advisory Board for the year 1931.**—Med. 8vo, 21 pp. Kuala Lumpur, 1932.

In addition to various local reports, information is given on work of a more general nature, much of which has already been noticed [*R.A.E.*, B, xx, 11, 199]. The results of the experiment with iron pyrites [xx, 11] have in general been satisfactory. Whereas *Anopheles maculatus*, Theo., had been breeding throughout the drainage system before the deposition of the iron ore, only occasional larvae have recently been found at the heads of drains before seepage water has had time to take up an appreciable quantity of iron.

An investigation was made into the continued incidence of malaria in an area where repeated larval surveys had revealed only one small, temporary breeding-place of *A. maculatus* and where no adults had been taken in traps. During July catches made in a room containing human bait averaged 10 Anophelines a night, and of these 90 per cent. were *A. hyrcanus* var. *sinensis*, Wied., and *A. hyrcanus* var. *nigerrimus*, Giles. In August, the numbers decreased to an average of less than one a night, of which half were *A. vagus*, Dön. Dissections revealed sporozoites or oöcysts in 5 out of 106 individuals of *A. hyrcanus* var. *sinensis* and in 14 out of 185 of *A. hyrcanus* var. *nigerrimus*. No other species was found to be infected.

OTANES (F. Q.). **Notes on a venomous Spider in the Philippines** (*Latrodectes* **sp.—near** *hasselti* **Thorell).**—*Philipp. J. Agric.*, iii, no. 2, pp. 83–88, 2 pls., 2 refs. Manila, 1932.

In July 1931 cases were reported of the deaths of cattle in Occidental Negros following the bites of a species of *Latrodectus* closely allied to *L.*

hasselti, Thorell. The deaths of two birds and a white rat bitten in the laboratory by this spider proved that it is poisonous. It is apparently found in many parts of the Philippines. Suggestions are made for the treatment of bites in man and for the control of the spider, with notes from the literature on other members of the genus, particularly *L. mactans*, F.

FUJITA (S.). **On the parasitic Wasp of the Pupa of** *Tricholyga bombycis* **Bech. I.** [*In Japanese.*]–*Rep. Dept. Seric. Korea Agric. Expt. Sta.*, iii, no. 1, pp. 23–38, 1 pl. Korea, March 1932.

Descriptions are given of all stages of the Pteromalid, *Mormoniella vitripennis*, Wlk. (*Nasonia brevicornis*, Ashm.), which, in Korea, is parasitic in the pupae of *Tricholyga bombycis*, Bech., a Tachinid parasite of the silkworm [*Bombyx mori*, L.], and also attacks those of *Sarcophaga* spp. and the house-fly [*Musca domestica*, L.]. There are about 10 generations a year. The eggs are laid in the puparia of the host soon after pairing, and hatch in 1 or 2 days in summer. The total number of eggs laid by a female averages 100, and the number of parasites emerging from one host 37. The pupal stage is passed in the host puparium and lasts 5 days, the adults emerging about 6 days later. In spring and autumn the life-cycle occupies 27 days. The males live 3–6 days, and the females 4–11. This parasite has been found in breeding-houses of *B. mori*, but has not been seen in the field.

NATVIG (L. R.). **Om Myiasis samte to nye norske kasus.** [Myiasis in relation to two new Norwegian Cases.]—*Norsk ent. Tidsskr.*, iii, pt. 1–2, pp. 117–121, 20 refs. Oslo, 1932. (With a Summary in German.)

Two cases of intestinal myiasis in Norway are discussed. Larvae of *Fannia scalaris*, F., were recovered from the stools of the first patient, and in the second case a first consignment of three larvae of *Ptinus fur*, L., and a second consisting of one larva of *P. fur* and two of *Musca domestica*, L., were sent in for determination. Although it is possible for the patient to have swallowed larvae of *P. fur* with tainted food, it is unlikely that they could have passed through the digestive tract alive. The author is inclined to believe that *M. domestica* was responsible for the symptoms described, and that *P. fur* may have been already present in the receptacle used.

CARTER (H. R.). **Yellow Fever. An Epidemiological and Historical Study of Its Place of Origin.**—Med. 8vo, xii+308 pp., 1 pl., 1 fig., 3 maps, 18 pp. refs. Baltimore, Md., The Williams & Wilkins Co., 1931. Price 26*s*. 6*d*. [Recd. November 1932.]

This posthumous publication is edited by L. A. Carter and W. H. Frost, who state that as the observations made since the author's death in 1925 in no way conflict with his view of the epidemiology of yellow fever, but tend in general to confirm inferences or conjectures previously lacking experimental proof, his discussion is presented without change, but with notes calling attention to necessary modifications in certain statements of detail.

From the epidemiological point of view, the continued existence of yellow fever in nature depends on the presence of the causal organism, a susceptible population and the insect vector, *Aëdes argenteus*, Poir. (*aegypti*, auct.). In the first part of the book these factors are discussed in detail, together with the conditions limiting their occurrence and dispersion. The second part deals with the diseases that have been or might have been confused with yellow fever in the past.

In the third and largest part, the historical data on the incidence of the disease in various parts of the world are discussed in the light of the known epidemiology with a view to establishing its place of origin. For example, the reported existence of yellow fever for a period of years under conditions in which the necessary factors could not have survived proves that the disease in question could not have been yellow fever. It is concluded that such biological evidence as is available is entirely in favour of the view that yellow fever is of West African, and not American, origin and that this is confirmed by historical evidence, though the latter alone might not be altogether conclusive.

GIBBINS (E. G.). **Natural Malaria Infection of House-frequenting *Anopheles* Mosquitoes in Uganda.**—*Ann. Trop. Med. Parasit.*, xxvi, no. 3, pp. 239–266, 6 figs., 3 refs. Liverpool, 29th October 1932.

An account is given of Anopheline infectivity surveys carried out at Kampala from May 1929 to April 1930, at Jinja for 4 months from June 1930, at Fort Portal for 5 months from September 1931 and at Mbale during the month of April 1932, much of the information on the first two surveys having already been noticed [*R.A.E.*, B, xix, 190]. As these four regions differ considerably in their chief physical features, it is inferred that the 6 species of *Anopheles* found to be concerned in the dissemination of malaria are fairly representative of the vectors in Uganda. To simplify the diagnosis of the oöcyst on the stomach wall and to allow the alimentary tract to become freed of blood, the females were kept for one week before dissection, and the method of keeping them alive in separate test tubes is described.

The following is largely taken from the author's summary : *Anopheles gambiae*, Giles (*costalis*, Theo.) is the most dangerous malaria vector in the country. The percentage of adults found to harbour malaria parasites was 18·6 at Kampala, 17·8 at Jinja, and 24·2 at Mbale. The distribution of this species in Uganda appears to be governed principally by temperature. It was common about the warm, sunny towns at elevations of 4,000 ft., whereas at Fort Portal (5,000 ft.) during the wet season when the prevailing temperature was comparatively low, in spite of the presence of numerous apparently suitable breeding-places, it was seldom found, and the few dissections made gave negative results. When the temperature is favourable, its prevalence is greatly influenced by rainfall. *A. funestus*, Giles, is the most abundant vector in Uganda, and dissections showed that 14·8 per cent. were infected at Kampala, 9·2 at Jinja, 5 at Fort Portal and 9·7 at Mbale. The form of *A. theileri*, Edw., encountered in Kampala [*cf. loc. cit.*] was var. *hancocki*, Edw., which was found to be an important vector in one locality in the vicinity, the infection rate being 11·4 per cent. At

Jinja *A. moucheti*, Evans, was found to be of considerable importance as a vector, the infection rate being 8·3 per cent., and *A. pharoensis*, Theo., although limited in distribution, showed a rate of 5·9 per cent. [*cf. loc. cit.*]. *A. mauritianus*, Grp., which occurred in all four localities, habitually frequented houses only at Jinja, where the form encountered was var. *ziemanni*, Grünb. [*cf. loc. cit.*]. Dissections of this variety and of *A. transvaalensis*, Cart., which was common in houses in Fort Portal, revealed no infections. Both these mosquitos have been observed to bite man, but their presence in unusual numbers in huts almost always coincides with that of goats, and it is probable that they prefer animal blood. *Anopheles marshalli*, Theo., occurred in the high country surrounding Fort Portal ; 0·3 per cent. were infected. Dissections of 7 out of 14 individuals of *A. nili*, Theo., taken at Jinja [*loc. cit.*] revealed no infection.

A study of pigmented oöcysts occurring in *A. gambiae*, *A. funestus* and *A. theileri* var. *hancocki* at Kampala suggests that each is concerned in the dissemination of all three forms of human malaria. The recognition of oöcysts of more than one species on the stomach of a single mosquito indicates the possibility of the individual insect transmitting mixed infections. The fact that the maturation of oöcysts takes longer in *A. theileri* var. *hancocki*, *A. moucheti* and *A. pharoensis* than in *A. gambiae* and *A. funestus* is indicated by the considerably smaller percentages of gland to stomach infections recorded in them. The heaviest intestinal infection occurred in *A. gambiae*, in which over 100 oöcysts were recorded on 4 occasions and 205 in one mosquito.

Gordon (R. M.), Hicks (E. P.), Davey (T. H.) & Watson (M.). **A Study of the House-haunting Culicidae occurring in Freetown, Sierra Leone ; and of the Part played by them in the Transmission of certain Tropical Diseases, together with Observations on the Relationship of Anophelines to Housing, and the Effects of anti-larval Measures in Freetown.**—*Ann. Trop. Med. Parasit.*, xxvi, no. 3, pp. 273–345, 5 graphs, 2 maps, 2 pp. refs. Liverpool, 29th October 1932.

It is now generally recognised that in order to utilise the information obtained from a larval survey, it is essential that it should be correlated with a study of the species and numbers of mosquitos occurring in houses and biting out of doors. The breeding-places in Freetown appear to have been adequately dealt with [*R.A.E.*, B, xiv, 63, etc.], but previous observations on adults [xviii, 174, etc.] have been based on small numbers not collected in a systematic manner. For this reason the investigations described were undertaken in Freetown during the rainy seasons (June to November) of 1930 and 1931 and at Kissy, a native village about 6 miles distant, during both dry and rainy seasons. During these periods native huts were systematically examined and 5,371 mosquitos were caught, including 2,996 *Anopheles gambiae*, Giles (*costalis*, Theo.), 2,175 *A. funestus*, Giles, 28 *A. nili*, Theo., 30 *A. rhodesiensis*, Theo., and 1 *A. rufipes*, Gough. Only 141 Culicines were taken, but it is doubtful if these observations give a true estimate of the mosquitos that have entered houses during the previous 24 hours, as they frequently enter after dark and leave before daylight. Only

A. gambiae occurred in appreciable numbers in Freetown, whereas in Kissy *A. gambiae* and *A. funestus* were found in almost equal numbers. A few outdoor observations on mosquitos biting at night in Freetown, made towards the end of the rainy and dry seasons and during the first part of the rains, confirmed the findings of house examinations as regards the comparative scarcity of mosquitos there. In similar observations at Kissy during the rains, the mosquitos found biting were four times as numerous as in Freetown. Moreover, *A. theileri*, Edw., and *A. mauritianus*, Grp., were common outdoor biters at Kissy, although none was taken indoors. The monthly incidence of Anophelines in Freetown and in Kissy is closely associated with rainfall and reached its maximum at the height of the rains ; in Kissy the figure was 23 per room and in Freetown 1 per room. The rise in the rate for *A. gambiae* antedated that for *A. funestus* by about 2 months.

The feeding of laboratory bred individuals of *A. gambiae* and *A. funestus* on crescent carriers proved that *A. funestus* is also capable of allowing the complete development of *Plasmodium falciparum* [*cf.* xviii, 175]. It is not known which of these two species is the more easily infected, but owing to its larger size *A. gambiae* probably takes about twice as much blood, and it also bites man more readily. The exact technique used for the dissection and examination of the mosquitos is explained. Of the 5,230 Anophelines taken, 3,267 were dissected and *A. gambiae, A. funestus* and *A. nili* were found to contain parasites, the respective percentages of infection being 11·1, 12·5 and 0 in Freetown and 16·3, 7·0 and 27·3 in Kissy. Although the infection rate of *A. nili* is high among the small number dissected, the concentration of this species at Kissy is so low that the part played by it in the local transmission of malaria must be insignificant in comparison with that of the other two species. In view of the preponderance of *A. gambiae* in Freetown and its high salivary gland infection rate (8 per cent.), it must be held responsible for the transmission of malaria in this town. In Kissy the percentage of salivary gland infection in *A. funestus* was 4 and in *A. gambiae* 11. The sporozoite rate showed little seasonal variation in either species, but the risk of contracting malaria was greater during the rains, owing to the greater concentration of Anophelines in houses.

Observations support the theory of Perry (1912) that Anophelines can be divided into 4 groups of different relative ages according to the stage of deterioration of their wing scales. In Kissy and Freetown old Anophelines predominated during the dry season and young ones during the rains. A steadily increasing percentage of malaria infection occurred in each successive wing grade ; this was not true of infection with *Filaria* (*Wuchereria*) *bancrofti*. The majority of Anophelines infected with malaria and *F. bancrofti* belonged to the second grade, which, although not showing the highest percentage of infection, is therefore the one most responsible for their transmission. No association was demonstrated between the number of native children (who represent the gametocyte carriers) and the infection rate amongst Anophelines found in a house or district. From staining experiments it is concluded that in the great majority of cases, *A. gambiae* and *A. funestus* leave a native hut within 24 hours of having fed. There is no evidence of any return habit. On the basis of known facts regarding the age, infection rate, dispersion and feeding habits, etc., of the species in question, it is surmised that an almost complete change in the Anopheline population of each house occurs every 24 hours. A comparison of well-lighted and badly-lighted houses in Freetown showed that more of the latter contain Anophelines and that the concentration in them is almost four times as great. It is suggested that this does not necessarily indicate that fewer Anophelines enter well-ventilated houses, but rather that they leave them at an earlier hour because they are well lighted.

It has been shown [see next paper] that *A. gambiae* and *A. funestus* can be experimentally infected with *F. bancrofti*, which develops in them to the infective stage (proboscis form). Since in the case of this parasite, the presence of gut or thoracic forms in a mosquito may not indicate the possibility of further development, the authors consider that the best evidence of infectivity is the presence of head or proboscis forms. These forms were seen in 1 per cent. of *A. gambiae* dissected from Freetown, and in 2·7 per cent. of this species and 1·2 per cent. of *A. funestus* from Kissy. It is probable that Culicines play some part in the transmission of filariasis in both localities, but their importance compared with Anophelines is considered negligible. The rate of infection with *F. bancrofti* varied considerably according to season, being three times as great in the wet season as in the dry, and it is suggested that, as there is little difference in the temperature in the two seasons, higher humidity may favour the infection of Anophelines.

The last section of the paper deals with the history of anti-mosquito measures in Freetown from their inception in 1899 up to the present time. It would appear that there has been a remarkable diminution in the number of mosquitos during the past 30 years. In Kissy, where permanent drainage and similar methods of control have not been applied, Anophelines are still very common. A comparison of the Anopheline rate per room in 1930 and 1931 showed that there was an increase in 1931 in streets in Freetown where drainage conditions had remained unchanged but a decrease in streets drained since the first observations in 1930 [xx, 34].

Hicks (E. P.). **The Transmission of *Wuchereria bancrofti* in Sierra Leone.**—*Ann. Trop. Med. Parasit.*, xxvi, no. 3, pp. 407–422, 25 refs. Liverpool, 29th October 1932.

In Freetown, infection of man with *Filaria* (*Wuchereria*) *bancrofti* is common, but its vectors have never been definitely determined. Workers dissecting captured mosquitos have found larvae thought to be those of *F. bancrofti* [*cf.* preceding paper, etc.], but the truth of this can only be proved by experiments, such as are described in this paper, in which laboratory bred mosquitos are fed on persons known to be infected with this parasite and dissected at suitable intervals after the feed.

The following is taken from the author's summary: Complete development of the filarial larvae was observed in *Anopheles gambiae*, Giles (*costalis*, Theo.), *A. funestus*, Giles, *A. rhodesiensis*, Theo., and *A. squamosus*, Theo. As the first two species have been found infected in nature, they must be regarded as important vectors. There is no record of natural infection in *A. rhodesiensis*, and its biting habits are uncertain ; its importance in the transmission of filariasis cannot therefore be decided. *A. squamosus* has been found infected in nature, but it is not common in Sierra Leone, and so cannot be an important vector. Of 39 individuals of *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) that fed and survived until the fourteenth day, only one developed an infection in the proboscis. This must be considered an exception, for many of this species have previously been fed experimentally and no complete development of the larvae has taken place. Moreover, dissections of mosquitos of this species caught in nature have shown no proboscis infections. *Culex nebulosus*, Theo., appears to be unwilling to bite man, as it could not be induced to do so under experimental conditions. It is thought to come into houses for shelter, and it can therefore be disregarded as a vector. Mature larvae dissected from *A. gambiae* and *A. funestus* bred in the laboratory and from the same two species caught in nature were indistinguishable and conformed to the usual description of the mature larva of *F. bancrofti*.

PATTON (W. S.). **Studies on the Higher Diptera of medical and veterinary Importance. A Revision of the Species of the Genus *Musca* based on a comparative Study of the Male Terminalia. I. The natural Grouping of the Species and their Relationship to each other.** —*Ann. Trop. Med. Parasit.*, xxvi, no. 3, pp. 347–405, 26 figs., 29 refs. Liverpool, 29th October 1932.

The following are the author's conclusions : The comparative study of the male terminalia of 41 species of the genus *Musca* proves these parts to be of a remarkably uniform structure in all, especially the phallosome (penis), thus showing the very close affinities of the species. There is, therefore, no valid reason for splitting the genus into smaller genera. The species fall into three natural groups on the characters of the male terminala, the posterior part of the paramere exhibiting a remarkable development from a simple plate to a large, upright process. The *domestica* group contains the simplest forms, the *lusoria* the most specialised, and the species of the *sorbens* group occupy an intermediate position.

The species with a blood-drawing proboscis fall into the three groups, showing that the blood-sucking habit has been evolved independently in each group along the same lines, and more than once, proof of the real significance of these terminalic characters as a sure guide to the true status of these puzzling forms. The larviparous species fall into two of the groups, the first and the third, and the species (*planiceps*, Wied.) with the most advanced viviparous habit belongs to the first, showing that simple terminalic characters are quite consistent with a highly specialised larviparous habit (*cf. Glossina*), again proving the great value of the terminalia as a guide to the true affinities of the species.

Grouping of the species into smaller genera, and isolating single species into distinct genera, on such characters as the presence or absence of hairs, bristles, thickness of proboscis, etc., have led to a complete misunderstanding of the true nature of these seemingly anomalous or atypical species.

PAPERS NOTICED BY TITLE ONLY.

STUPPY (C.). **Stechmücken als Ueberträger der Hühnerpocken.** [Mosquitos as Vectors of Fowl-pox.]—*Anz. Schädlingsk.*, viii, no. 10, pp. 119–120, 3 refs. Berlin, October 1932. [*Cf. R.A.E.*, B, xx, 149.]

MACGREGOR (M. E.). **Certain pathological Effects of Ultra-Violet Radiation on Mosquito Larvae and Pupae.**—*Proc. Roy. Soc.*, (B) cxii, no. 774, pp. 27–38, 1 pl., 1 ref. London, 1st November 1932.

GREEN (R.). **A rapid Method of staining and mounting Mid-guts of Mosquitoes for the Demonstration of Oöcysts.**—*Parasitology*, xxiv, no. 3, pp. 305–306. Cambridge, October 1932.

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BUXTON (P. A.). **The Relation of Adult** *Rhodnius prolixus* (**Reduviidae, Rhynchota**) **to atmospheric Humidity.**—*Parasitology*, xxiv, no. 3, pp. 429–439, 4 figs., 6 refs. London, October 1932.

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WAGNER (J.). **Zur Morphologie der letzten Abdominalsegmente der Flöhe.** [Morphology of the last abdominal Segments in Fleas.]—*Zool. Jahrb.*, Abt. Anat., lvi, no. 1, pp. 54–120, 49 figs., 22 refs. Jena, 27th October 1932.

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